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STANDARDIZED X-RAY CEPHALOGRAPHICS

HERBERT I. MARGOLIS, D.M.D., BOSTON, MASS.

AN ORTHODONTIST interested in facial growth and dental changes may be compared somewhat to an art connoisseur who examines a painting first from a distance to get the composition or theme, then approaches closer and closer, examining the work more and more in detail.

Thus, having obtained standardized stereophotographs described by the writer in the previous article, he has a comparative record of the outer contours and proportions of the face and head.

The next step is to peer within the face at the skeletal structures "so fearfully and wonderfully made." It is of considerable interest to record the dentition in its developmental path with relation to other structures.

The field of operation of the orthodontist in a large measure is the lower third of the face. The changes in position of the dentition induced by orthodontic therapy for children are concomitant with facial growth and development. The orthodontist, then, by the very nature of his work cannot dissociate the dentition from the bones of the face of his young patients. The interdependence of one upon the other has been amply emphasized by the anthropologist as well as the orthodontist.

To construct an x-ray cephalogram for comparative study, it is imperative to standardize all the component factors: the central ray, position of the child's head and x-ray film. Of course the details attending the exposure, time, current, voltage, as well as those involved in processing the film, must likewise be carefully observed.

THE ADJUSTABLE X-RAY CEPHALOSTAT

The adjustable cephalostat is a precision instrument designed for the purpose of holding both the child's head and the x-ray negative in a desired and recordable relation each to the other, as well as to the central x-ray.

Instructor in Oral Anatomy, Harvard Dental School; Visiting Orthodontist, Beth Israel Hospital, Boston.

A rigid casting supports both the slide for the x-ray casette, and a graduated circular disk to which is attached another disk capable of rotating 360 degrees. A graduated horizontal slide supports two extensions, each of which carries an ear rod. It is important to note, therefore, that both ear rods may be moved toward the center. Another extension supports a pointer. This orbital pointer with the two ear rods forms the horizontal plane.

To further maintain the head in a rigid position, there is a support that approaches the top of the head and an adjustable rest which can be fixed around the mandible at the chin region (Fig. 1).

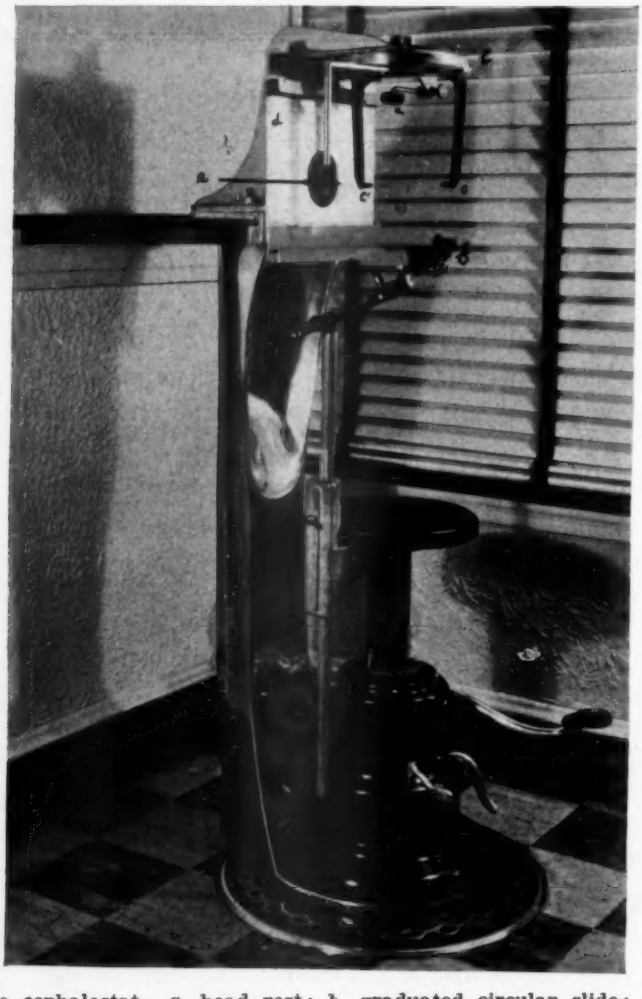

Fig. 1.—Adjustable cephalostat. *a*, head rest; *b*, graduated circular slide; *c.c'*, ear rods on horizontal graduated slide; *d*, casette holder; *e*, orbital pointer; *f*, adjustable chin rest.

The child's head may be quickly and effectively immobilized before exposure of the x-ray film.

It has been mentioned that this apparatus permits the rotation of a complete circle. In other words, the head may be rotated so that the sagittal plane may be at any angle to the central ray. Thus, it is possible to obtain x-ray cephalograms with the central ray perpendicular to the sagittal plane for the construction of sagittal cephalic x-rays, usually termed profile x-rays (Fig. 2). Rotation of the instrument and the head makes possible the con-

struction of frontal cephalic x-rays commonly termed anteroposterior x-rays (Fig. 3). Also it is possible to obtain one side such as the familiar lateral jaw x-ray, which, in this case however, would be standardized so that the procedure may be repeated and comparative negatives obtained. Such views

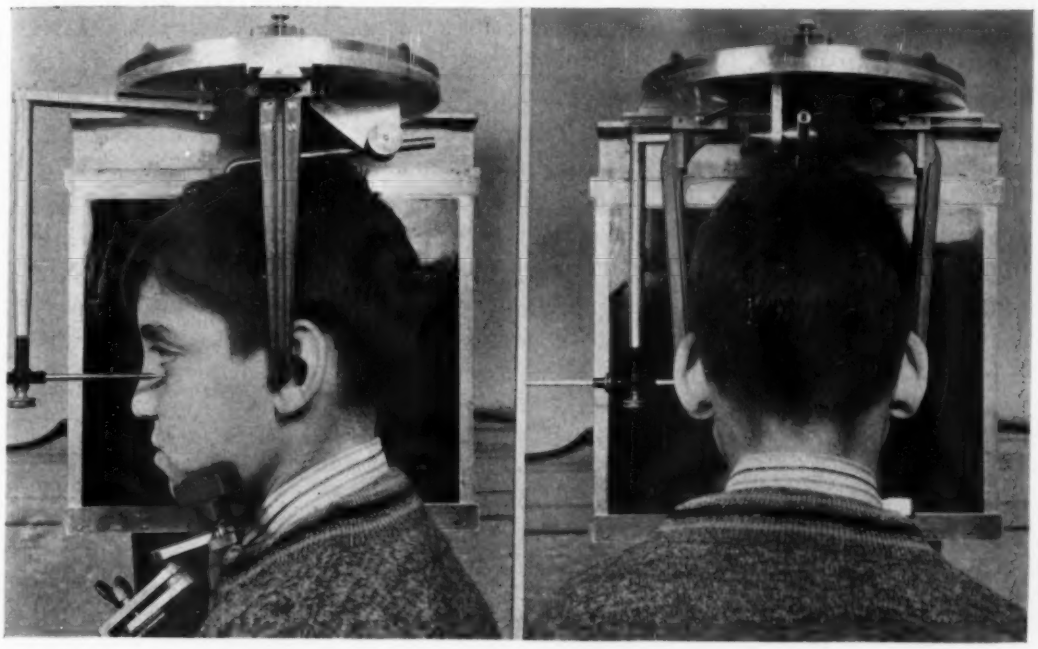

Fig. 2. Fig. 3.

Fig. 2.—Patient set up in adjustable cephalostat for sagittal x-ray. Note cylindrical hole in ear rod. Similar hole in other ear rod. (See Fig. 10.)

Fig. 3.—Patient set up for frontal x-ray. (See Fig. 11.)

Fig. 4.—Patient set up for standard lateral jaw x-ray without superimposition. Head may be set at any desired angle to central ray. Film of adequate size may be used. (See Fig. 12.)

may be desired when the usual sagittal or frontal angulation results in excessive superimposition of other anatomic structures (Fig. 4).

CENTRAL X-RAY DIRECTOR

In this technique, the x-ray machine used for the construction of cephalic x-rays is the same one which the writer uses for all his x-ray needs that are necessary in practice. In order to obviate the necessity for other machines, it is essential that the head of the x-ray apparatus be quickly and accurately adjusted in the desired position. Also, it must be possible to duplicate the position of the machine with the utmost precision whenever necessary. Therefore, a rigid casting was constructed from a properly fitted pattern which fits around and is attached to the head of the x-ray machine. This casting must, of course, be so constructed and so attached that it has adequate rigidity and allows for no motion between it and the head. In fact, it becomes a part of the x-ray machine, which fits into a counterpart, supported on a table. The height is determined so as to bring the central ray at desired height above the floor and in line with the ear rods.

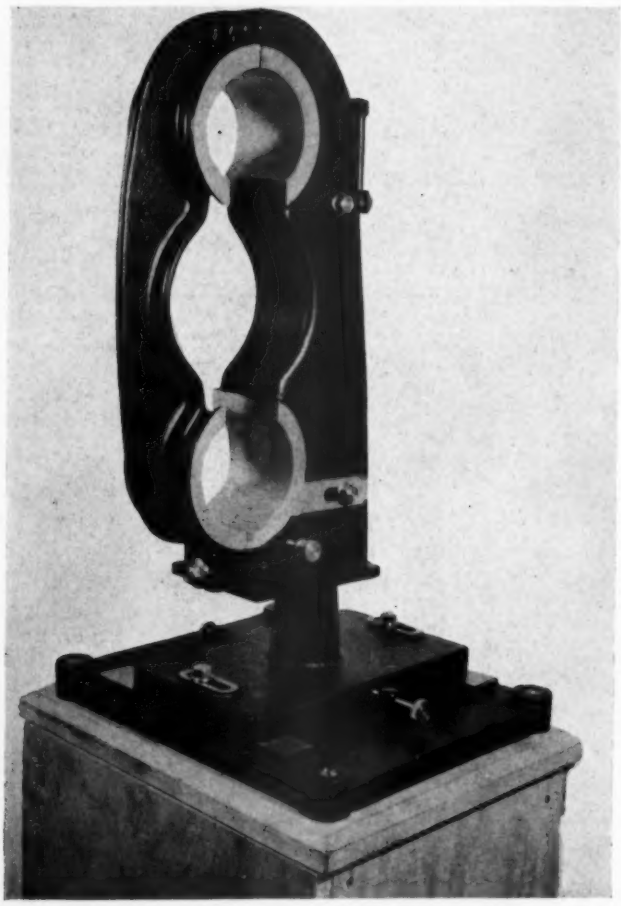

Fig. 5.—Apparatus for fixation of x-ray head. (See Fig. 6.)

It takes but a few seconds to grasp the head of the x-ray machine and position it, by means of its projecting casting, into its counterpart. The

central ray may thus be directed with precision in relation both to the patient and x-ray casette, as will be described in this article (Figs. 5 and 6).

DIRECTING THE CENTRAL X-RAY

The adjustable cephalostat has two short sturdy ear rods, each having a cylindrical hole throughout its length (Fig. 2). It is obvious that when an x-ray is taken with the patient's head adjusted for the sagittal exposure and the head of the x-ray machine in position, when these two cylindrical holes appear as two circles, one within and concentric to the other, the central ray must be passing through the central axis of those two canals. Also, it indicates quite clearly that these canals are lined up perfectly one with the other. Likewise the film in turn must be perpendicular to the long axis of both tubes as well as to the central ray. The slightest measurable variation in these factors of the central ray to the ear rods or casette would change the shape of these circles and would cause them to intersect on the film or appear as ovals rather than circles.

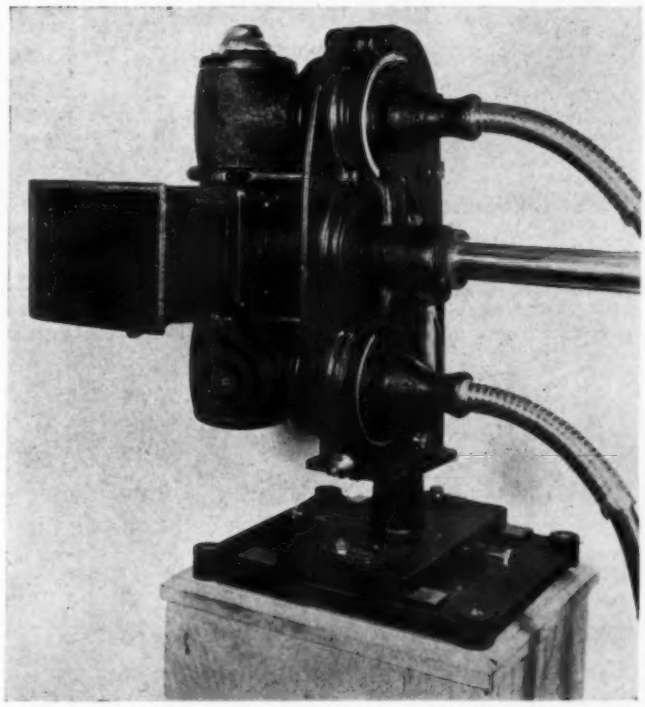

Fig. 6.—X-ray machine in director. Micrometer adjustments. X-ray may be positioned in a few seconds for directing the central ray with precision. (See Fig. 5.)

It is possible at any time to make an exposure on a small dental film to check up the accuracy of the setup (Fig. 7).

In the event that there is a slight intersection of the circles, it is possible to make corrections by means of a micrometer adjustment, available on the apparatus. The writer in his office makes these checks at various intervals, finding in most cases no change since the apparatus is quite rigid and remains constant. However, if an error has been made or some part of the apparatus has moved, it is immediately evident in the x-ray negative, and adjustments

can be made before any more exposures are taken. The setup is correct only when the central ray is properly directed and passes through the center of the cylindrical holes of the two ear rods and is perpendicular to the casette. Then, and only then, as has also been explained, will the resultant negative display two circles, one concentric to the other (Figs. 7 and 10).

The short ear rods entering the ear holes are tapered according to the measurements of the external acoustic meati from Bezold's measurements. Rubber caps, a few thousandths inch in thickness, may be superimposed over the short ear rods to fit different sized ear holes.

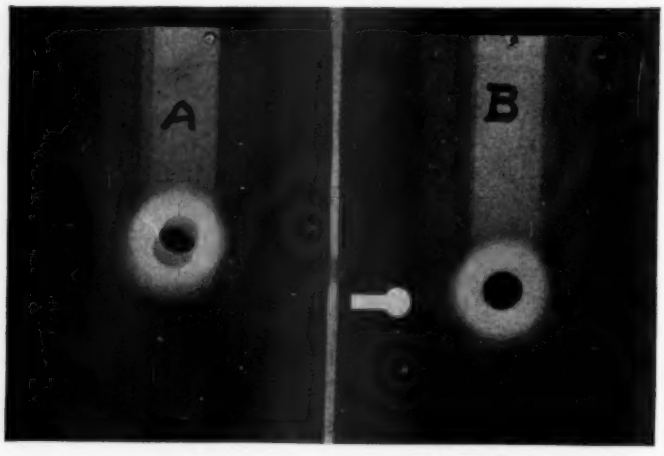

Fig. 7.—Check x-rays indicating lineup of central ray to ear rods and x-ray film. When any one factor is out the very slightest amount, two intersecting circles will result projected on the x-ray negative, *A*. When central ray is perfectly lined up, passing through the center of the cylindrical holes in both ear rods and perpendicular to the casette, then *B* results.

This telltale check can be seen on the x-ray and will indicate the precision of the setup. (See Fig. 10.)

RATIO OF ENLARGEMENT

If one were to measure an object, directly, with a pair of calipers, he would, of course, obtain actual dimensions. X-rays however, it must be borne in mind, form a cone, the apex of which is at the anode and the base on the film. If an x-ray is taken of a cylindrical tube with the central ray passing through the longitudinal axis of the tube, the opening nearest the film, of course, will be smaller than the one nearest the anode.

Therefore, the ratio of enlargement of the median sagittal plane of the patient on the negative will be the quotient of the anode-film distance divided by the anode-median plane distance.

Where (a) = anode object distance
(b) = anode negative distance

Then the rate of enlargement $= \frac{b}{a}$.

It has been indicated that in this procedure the anode, median sagittal plane, and film are always in the same position, relative to each other.

Therefore, the ratio of enlargement is constant at the median sagittal plane for all heads, regardless of size.

Likewise, it is not necessary to have a vertical indicator placed in the region of the profile to indicate the ratio of enlargement for each exposure.

With this cephalostat then, because of the fixation of the factors, there are the following advantages:

1. There is a constant ratio of enlargement for all heads at the median sagittal plane.

2. A more balanced support is afforded the head decreasing the possibility of motion because two short sturdy ear rods instead of one short and one long rod support the external acoustic meati (Figs. 3 and 9).

PROCEDURE FOR TAKING CEPHALIC X-RAYS

A pair of calipers, similar to the procedure described under stereophotography, is placed in the child's ear holes while the child is seated comfortably in the chair. Since the child is not yet adjusted in the cephalostat, the calipers may be placed as far as it is comfortable for the child when the teeth are closed. The intra-acoustic distance thus obtained is recorded (Fig 8). A small pencil mark is made, indicating the lowest point of the inferior border of the left orbit.

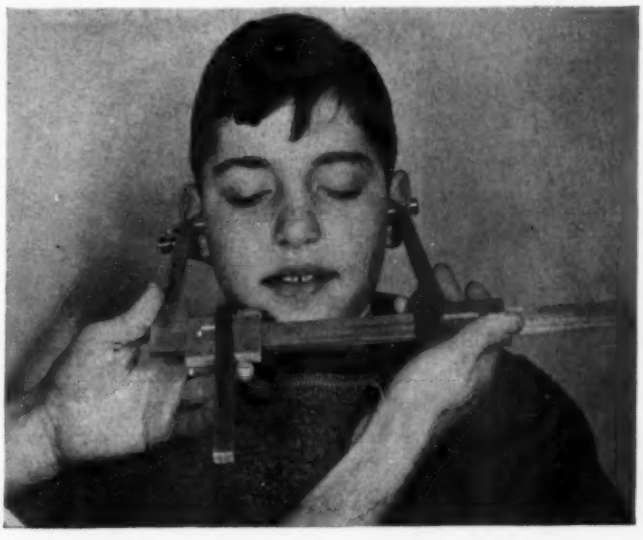

Fig. 8.—Intra-acoustic distance obtained before the child is placed in the cephalostat.

Before placing the child in the cephalostat, one ear rod is fixed by tightening its gib half the intra-acoustic distance, determined with the calipers. Then, the child is placed in the cephalostat for the sagittal view. The head is placed so that fixed ear rod enters the corresponding ear. This is accomplished by guiding the head into position until the rod is within the ear hole. Then, the opposite ear rod should enter its respective hole the same distance from the center as the fixed rod. Without questioning the child, it is known when the rods are inserted to the amount determined by the previous measurements of the intra-acoustic distance. The head is elevated until the orbital pointer touches the orbital point. The chin rest may be quickly adjusted and the occipital support dropped and tightened (Fig. 9).

In order to construct the frontal cephalic x-ray, it is necessary to rotate the circular slide 90 degrees. With some children it is necessary to loosen the apparatus on one side and readjust for the next exposure (Figs. 10 and 11).

In all techniques for the construction of cephalic x-rays it is customary to insert ear rods into the patient's ear holes. Some investigators, however, do not consider it important to determine in advance how far the ear rods enter the tubes. The writer, however, feels it is quite important to enter the acoustic tubes as far as the patient will permit in comfort.

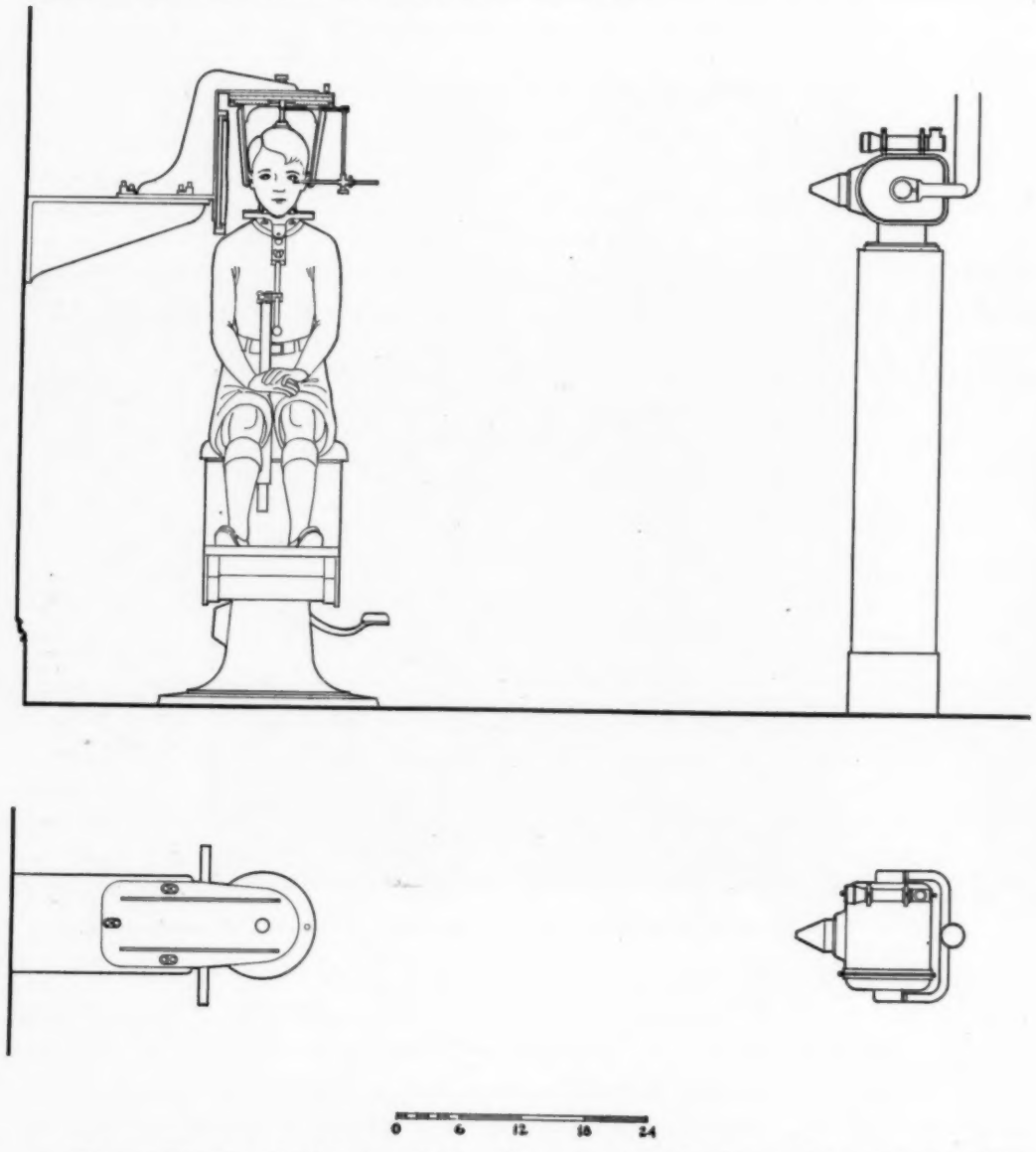

Fig. 9.—Diagram of setup in author's office. Note the telescope on the x-ray. Cross line on mirror in telescope will coincide with the cross line on the instrument only when the central ray is properly directed.

Since the acoustic tubes are somewhat tortuous and have the greatest amount of soft tissue at their lateral extremities, the child's head may rest on a different point on one side than on the other, either anteriorly or vertically when the ear rods enter the canals inadequately. This results in the rotation of the head in a corresponding vertical or anterior position. These rotations

of the head, due to improper placement of the ear rods within the tubes, may not be evident in the region of the central ray. They will, however, be increasingly evident in areas more remote.

If a different landmark is utilized in either acoustic tube in the setup of the patient, the sella turcica may show little or no change at different exposures. However, the angles of the mandible, the posterior teeth, as well as other lateral structures of the face and cranium, will show a change corresponding to the maladjustment. These distortions may be minimized by inserting the ear rods as far as the patient will permit in comfort.

A very interesting phenomenon was evident to the writer when he noticed the circles which are the projection of the canals within the ear rods to be black in a sagittal x-ray. After some study of the internal anatomy of both the acoustic tubes it appeared that this black projection was a superimposition of the internal and external acoustic meati (Fig. 10).

Fig. 10. Fig. 11.

Fig. 10.—Sagittal x-ray. Note the circle, superimposition of the cylindrical holes in both ear rods through which the central ray passes. This indicates the accuracy of all factors involved, central ray, patient, and film.

Also in this patient the central ray passes through the external as well as the internal meati, i.e., projection is black. (See Fig. 2.)

Fig. 11.—Frontal x-ray. (See Fig. 3.)

Then not only is the child's head set up on the external acoustic meati, but also the internal acoustic meatus, as it enters the brain cavity, is lined up on one side with the one on the opposing side of the cranium. This is an adequate indication of excellent orientation of the head.

Thus these little characteristic telltale circles are a permanent and indelible record of the accuracy of the entire apparatus as they appear on the negative, as well as affording valuable information of asymmetries within the skull (Fig. 10).

It has been argued that the necessity to rotate the child's head for different exposures is an inaccurate feature of this technique. Of course, if two tubes and two casettes, 90 degrees to each other, are used, it is unnecessary to move the patient's head for exposures.

It may be pointed out, however, that the accuracy of the superimposition of two or more x-rays taken at different times presupposes the ability of the operator to replace the child's head in the same position in the apparatus when previous exposures were made. In other words, a child is seated, his head fixed in a head holder and exposures made. Then six months later, the child returns to be placed in the same apparatus. The operator must, of course, place the child in the same relative position as in the original setup for purposes of comparison.

Therefore, it is reasonable to assert that it is a far easier task to rotate the child's head 90 degrees and maintain the same level in two exposures taken a few seconds apart.

Fig. 12.—Standardized lateral jaw x-ray. (See Fig. 4.)

And it is indeed possible, for the writer has so demonstrated to the complete satisfaction of able and critical engineers. This procedure of rotating the head from one angulation to another is a simple one and takes but a few seconds (Figs. 2 and 3).

STANDARDIZED LATERAL JAW X-RAYS

Oral surgeons and pathologists may wish to follow pathologic changes in a given area with the least amount of superimposition of the other side. The usual lateral jaw x-ray is rarely, if ever, duplicated, and it is obvious that the distortions confuse the pattern of changes taking place. With this technique, it is possible to construct lateral jaw x-rays with the head at a given angle to the central ray, rigidly supported by the cephalostat, with the same dispatch and accuracy that the sagittal and frontal exposures are made.

Similar x-rays may then be made with the patient's head at the same angle as previous and comparative x-rays obtained (Fig. 12).

It has been likewise similarly stated that two tubes are necessary for rigid fixation because it is maintained that it is impossible to replace the x-ray machine in exactly the same position. It certainly is possible to replace the machine, as evidenced by check x-rays (Fig. 7).

To summarize then for the construction of cephalic x-ray negatives:

1. Only one x-ray tube is necessary, instead of three, for cephalic x-rays as well as for all routine procedures.

2. Not only may the usual sagittal and frontal cephalic x-rays be constructed, but also any type of exposures with the head at a desired angle to the central ray.

3. The ratio of enlargement is standardized for all exposures.

4. The necessity for an indicator to determine the rate of enlargement for each exposure is eliminated since a constant ratio is established.

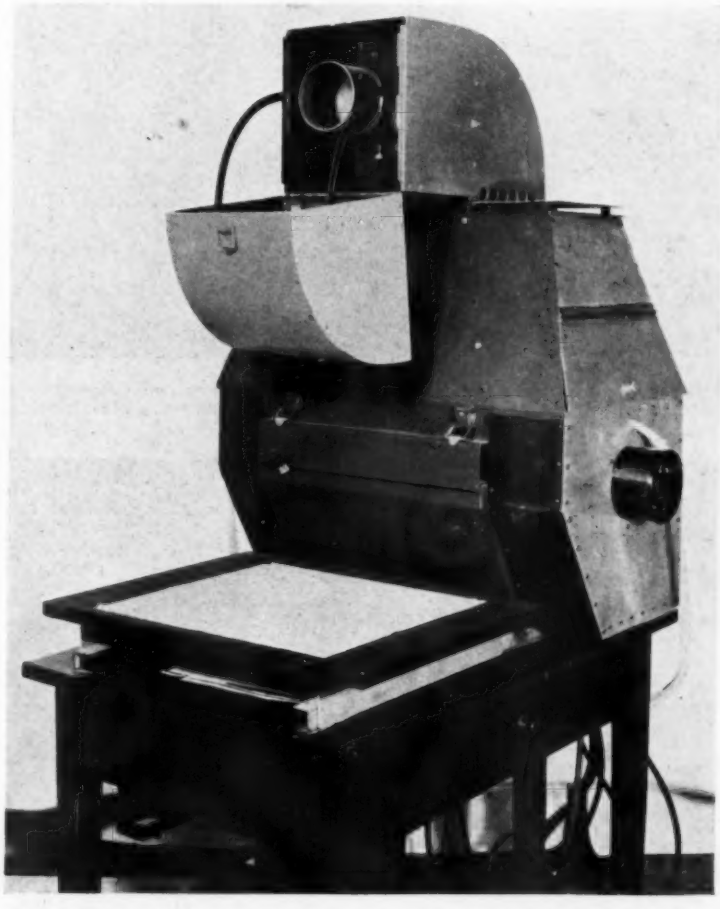

Fig. 13.—Projector—front segment dropped for vertical projection.

PROJECTION AND TRACING OF CEPHALIC X-RAY NEGATIVES

Having obtained a cephalic x-ray negative, it is necessary for purposes of comparison to transfer desired anatomic areas from the x-ray to a chart or graph, in order that these same areas, taken at different intervals, may be

Fig. 14.—Precision projector arranged with optical flat mirrors for projecting x-ray negatives directly on paper on the drawing board. All factors are standardized.

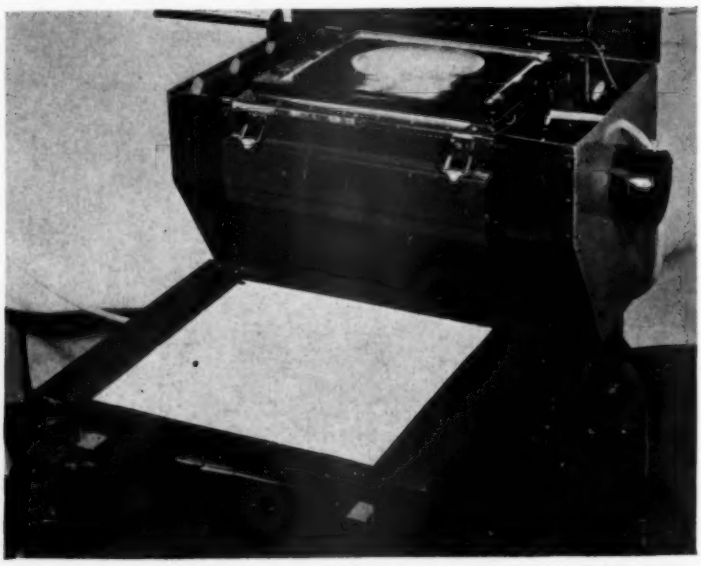

Fig. 15.—Projector may be used as an illuminating view box by throwing back the hinged segment.

superimposed, one on the other, to determine changes incident to growth or orthodontic interference.

Obviously, as much accuracy should be employed as in the rest of the procedure; for the most accurately constructed x-ray negative may be invalidated by improper transference.

One generally accepted method is to place the x-ray negative over a suitably lighted view box. Then, a paper is superimposed over the x-ray negative, and tracings are made of the desired areas on the drawing paper.

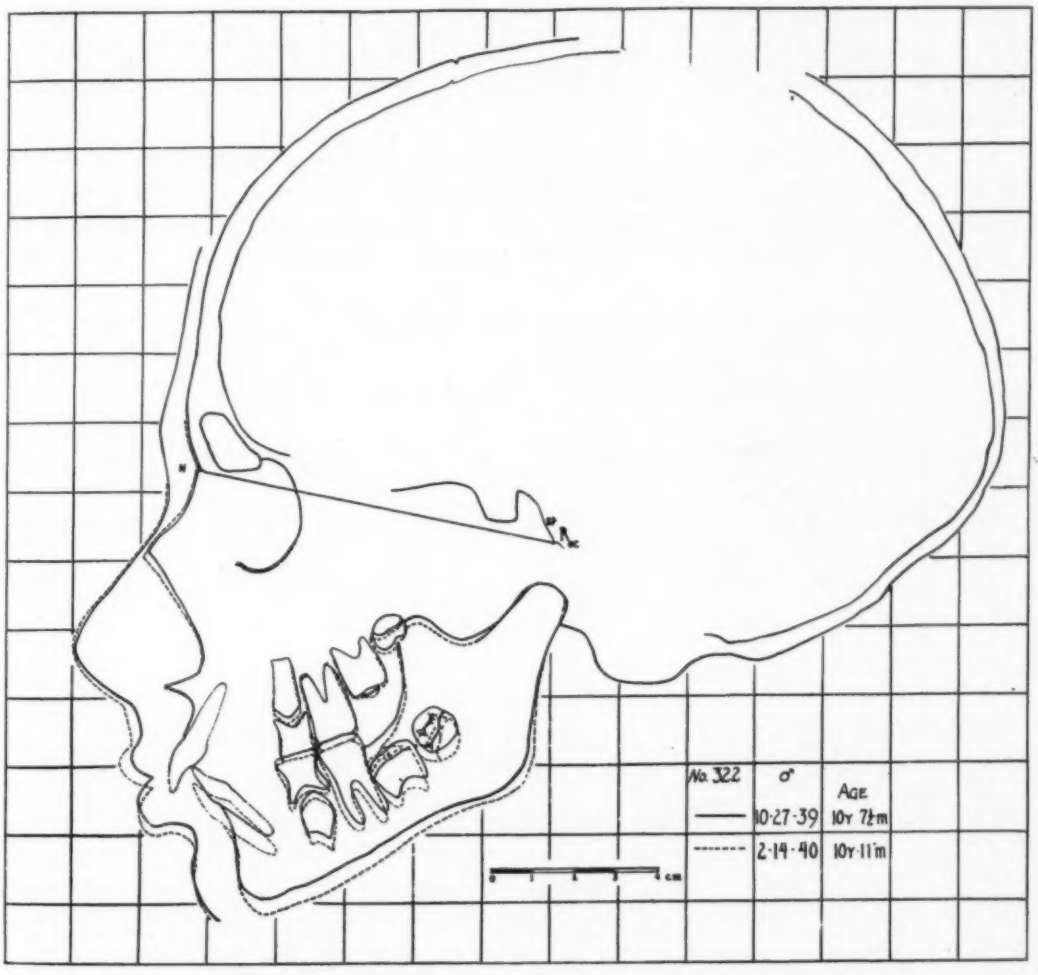

Fig. 16.—Superimposition of tracings of a patient who wore a bite plane at the initial stage of treatment.

The writer felt that even the best tracing paper except that made of cellophane, which presents other difficulties of manipulation, when interposed between the eyes and the film tends to fog out many landmarks on the x-ray which are not readily discernible. He has, therefore, designed a precision projector by which it is possible to make direct projections of the x-ray negative. This projector has a lens of known value and optical flat mirrors properly surfaced. When the x-ray negative is placed in its holder, it is projected directly on the drawing table. All the factors, namely: lighting, reflector, position of lens, angulation of mirrors, drawing board and x-ray

negative are in constant relation to each other. The factors are so designed that the projections of the x-ray on the drawing table are enlarged to be 1.5 times the actual size. This has the added advantage of making the pencil line finer in the tracing since it is not, of course, enlarged in the projection. The most minute and faintest structures on the x-ray may be projected directly on the drawing paper with the greatest precision and in the shortest possible time (Figs. 13, 14, and 15).

Also, it is a simple matter to check the accuracy of a tracer. All that is necessary is to observe whether the tracing coincides with the projection of the structure traced.

The accuracy of tracing may be further increased, if it is desired, by the use of a magnifying glass to determine if a given line is directly over its projection.

When a superimposition is desired of one tracing over another in order to determine change, it is merely necessary to project one x-ray on a tracing already constructed. This operation can, of course, be repeated as often and as much as is desired.

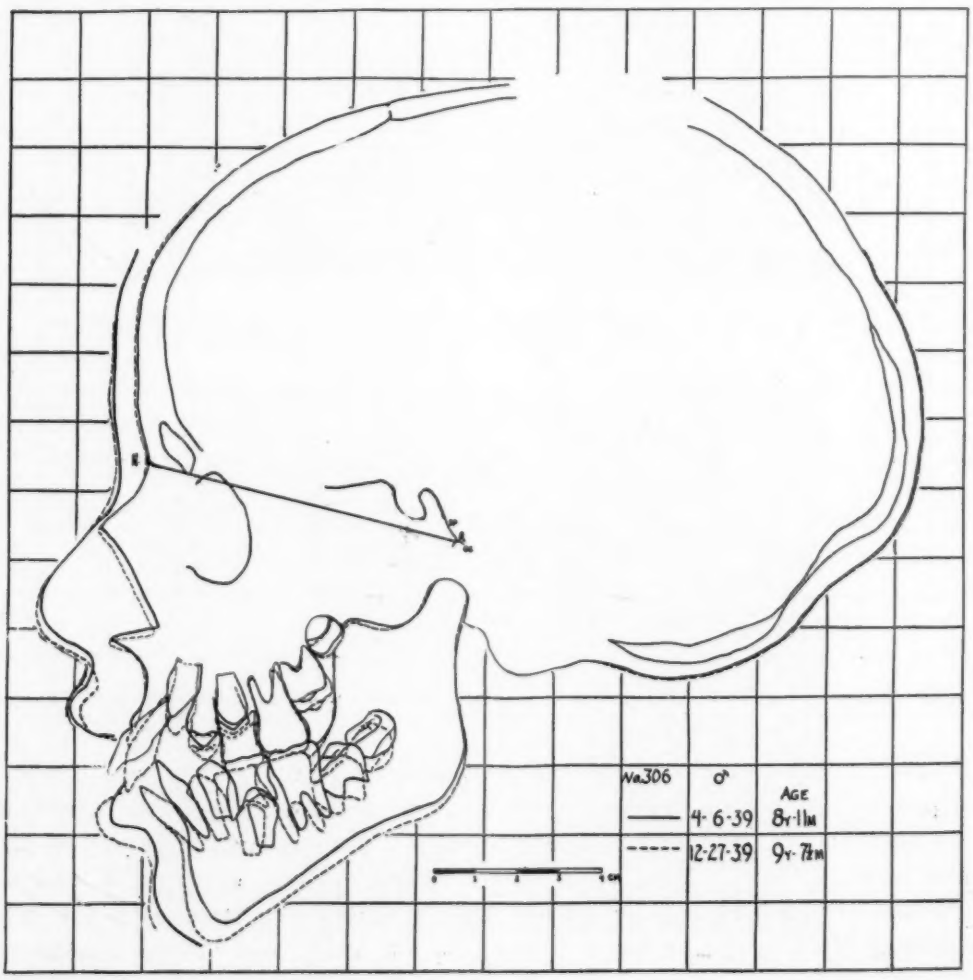

Fig. 17.—Superimposition of a case under treatment. Class II Division 1, Angle. Note that *R* is at the basilar suture between the occipital, *O*, and sphenoid, *S*, bones.

SUPERIMPOSITIONS OF CEPHALIC X-RAYS ON NASION-BASILAR CRANIAL BASE

The writer has long sought landmarks in order to form a base for superimposing one x-ray upon the other. While working for the late Martin Dewey, many years ago, it was impressed on the writer to avail himself of landmarks within the chondrocranium. The chondrocranium present in the majority of the vertebrates in the embryonic stage has neither lateral nor posterior walls and except at the extreme posterior end consists only of a ventrally situated plate. These cartilaginous bones of the skull which are formed in the chondrocranium are also confined to those same areas forming a floor for the brain. Likewise in higher vertebrates chondrification is limited to the basal region of the skull. In the human, ossification of the chondrocranium begins in the occipital region during the twelfth week, in four parts around the foramen magnum. At birth, the four parts are still separated by cartilage. It is not until the seventh year that pars basilaris joins with the rest of the bone and encircles foramen magnum. It is important to note that the union of basisphenoid and basi-occipital usually occurs when the growth of the individual

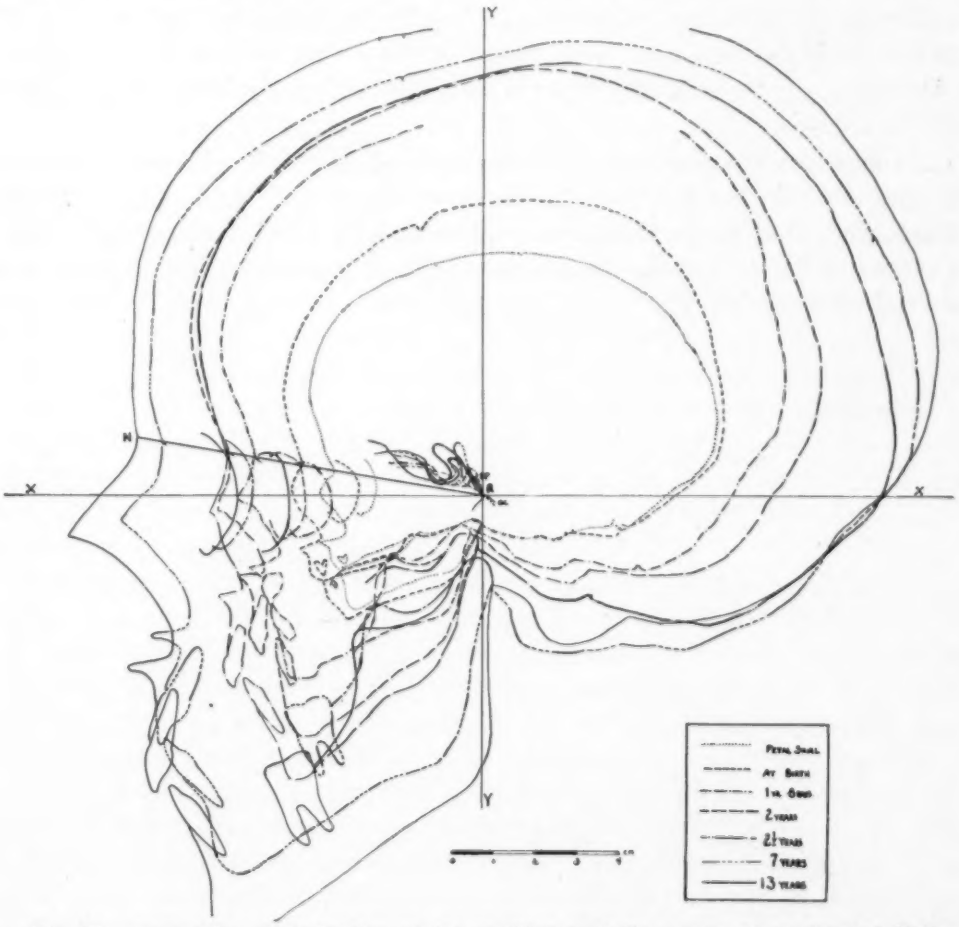

Fig. 18.—Composite of projection of the sagittal cephalic x-rays of skulls and living at indicated ages. The basal plane is projected as a line from the nasion to the basilar suture.

Registration, *R*, is at the basilar suture between the sphenoid and occipital bones at the base of the skull.

Horizontal plane, *X.X* passes through *R* at a constant angle of 10° to the base plane, *N R*. (Angle N R X = 10°.)

Transverse plane, *Y.Y*, also passes through *R* perpendicular to the horizontal plane.

ceases. It is also interesting to note the relation of the suture between the basi-sphenoid and basi-occipital to the pterygoid plates of the sphenoid bone throughout life.

The writer was impressed from his observations with the possibility that growth takes place above and below the base of the skull, anterior and posterior to the basilar suture between the sphenoid and occipital bones.

He would like to suggest, then, that a base for superimposition of x-rays be obtained by drawing a line from nasion to a point on the sphenoidal occipital suture. This point would serve as registration point, *R* (Figs. 16, 17, and 18).

The important thing in cephalometric studies by means of x-ray is to obtain standardized x-ray negatives with good detail. To make proper interpretation of a quantitative nature, it is necessary that all the factors be known.

Of course the investigators may use other means of orientation and superimposition providing the x-ray negative has been properly constructed and the tracing accurately made.

The geometrician has no concern as to why the object is a sphere or a cube, whereas the biologist always asks why a given shape and what is its relation to function. Therefore, it behooves the inquisitive clinician to accumulate accurate records.

He does not know what will be the by-product for it was only inquisitiveness that caused Ben Franklin to discover electricity. And it was the same characteristic that made Pasteur, the chemist who was interested primarily in the shapes of crystals, make discoveries that laid the foundation of bacteriology and modern medicine.

SOME RECENT OBSERVATIONS ON THE GROWTH OF THE FACE AND THEIR IMPLICATIONS TO THE ORTHODONTIST*

ALLAN G. BRODIE, D.D.S., M.S., PH.D., CHICAGO, ILL.

I SHOULD like, first, to express to my colleagues of the Central Section my deep appreciation of their motives in establishing this lectureship in memory of Edward H. Angle. It is very fitting that it should originate in the Middle West where he began his orthodontic work. I should like them to know, further, that I consider it a great honor to have been their choice as the first lecturer. It seems appropriate to open with a few reminders of the part in orthodontics played by the man we honor.

Although nearly ten years have elapsed since his death, it is only now becoming possible to judge the stature of Angle. His friends were overzealous and his enemies overbitter in their attitudes toward him. This in itself is frequently a sign of greatness, since only great issues or great characters seem to call forth such sharp divisions of opinion between otherwise amiable men.

It would be difficult to select Angle's most significant contribution, and perhaps it is too soon to attempt it. We can only record those things with which his name is associated and leave to the future the judgment of their relative importance. His classification of malocclusion, introduced in 1899, is universally accepted as marking the elevation of orthodontics to the status of a science. One year later, in 1900, he began his work as a teacher, a labor to which he devoted twenty-five of his best years. Practically all of the outstanding names in our specialty for the past forty years may be traced directly to this fountain-head. In 1901 this Society was formed, and he served as its president for the first two terms. By 1907 the graduates of his school had increased in number to the place where they felt the need of a special journal and *The American Orthodontist* was born. Destined to live only three years, this first special journal in the field of dentistry probably constitutes the finest single collection of orthodontic writings in our entire literature.

Among those who were not personally acquainted with him, Angle's name became associated with appliances and appliance systems. That word "system," dating back to his first important paper read before the Ninth Medical Congress in 1887, remained to haunt him like a discredited slogan of a disastrous campaign. That he was a perfectionist in the matters of technique and of appliance construction no one will deny, but the attention paid to this phase of his work has all but obscured the fact that he was one of the greatest biologic thinkers orthodontics has produced. The late T. Wingate Todd once characterized him as "the shrewdest scientific guesser I have ever encountered." His text, through its seven editions, bears mute testimony to the ever expanding concepts of his mind. It has been said of him by one of his closest friends that he stopped growing only when he died.

From the Department of Orthodontia, University of Illinois.

*The First Edward H. Angle Memorial Address, delivered before the American Association of Orthodontists meeting in Chicago, May 16, 1940.

The last years of his life were devoted to the social aspects of orthodontics. He saw storms ahead and sought to warn the specialty that society would have to be safeguarded against the incompetent if true orthodontics was to avoid sharing the blame of their misdeeds. His efforts were met by a storm of protest and of bitter denunciation and his moves were blocked. Today, every orthodontic society in the country has spread resolutions on its records calling for the very reforms he championed.

It can be said of Edward H. Angle that he was one of the few great men ever to grace the field of dentistry. It is a sign of greatness when any body of men, after bitter strife, can unite to honor such a one.

HISTORY

The methods that have been employed in the investigations on skeletal growth may be divided into a number of categories. We find: (1) Vital staining by madder feeding and alizarine injection. These methods, plus those in which inert materials (metallic and ivory implants, wires, etc.) have been used, have yielded important information on the sites of growth. (2) Microscopy has sought to elucidate the mode of bone growth and has credited the cell with the major role. (3) The structural architecture of bones in relation to their functions has tended to show that the two are interdependent. (4) Transplantations of bone anlagae have indicated that the form of bones is a matter of hereditary transmission. (5) The studies of the comparative anatomist have given us a picture of the phylogeny of the skeleton. (6) The anthropometrist has sought to measure growth by means of series of skulls and a few have attempted measurements of the living. But any single method carries its own limitations and the greatest limitation until recently was the lack of a method that would permit a study of the individual over the course of the growth period.

Although the use of an x-ray technique in growth studies had been predicted as early as 1922, its development for this purpose was not perfected until 1931. In this year Broadbent published the full details of a roentgenographic cephalometer and began a long range investigation of the head of the growing child.

In 1932 the Graduate Research Board of the University of Illinois authorized the installation of a Broadbent-Bolton cephalometer in the Department of Graduate Orthodontia, and since that time series of cephalometric roentgenograms have been taken on a variety of material. Among the studies undertaken have been: (1) the appraisal of the results of orthodontic treatment; (2) growth series on the various endocrinopathies, principally hypothyroidism, in cooperation with the Department of Endocrinology; (3) normal growth series on children from the Mooseheart Foundation; (4) growth series on the macaque monkey; (5) adult growth series in collaboration with the Department of Prosthetics. A rounding out of this program has been made possible by the fine spirit of cooperation that has existed with the Bolton Study of the Department of Anatomy, Western Reserve University. Its director, Dr. B. Holly Broadbent, has not only permitted the withdrawal from his files of valuable material but has been a source of unfailing help. I take pleasure in acknowledging publicly the great debt we owe him.

In 1938 the staff of the Department of Orthodontia collaborated on a report which consisted of a cephalometric appraisal of orthodontic results. Class I, Class II, and Class III cases were examined with a view to determining the nature of the changes that had been induced by treatment. The most startling finding was an apparent inability to alter anything beyond the alveolar process. The basic pattern was unaltered except for those changes which one might expect from growth. It became apparent that the normal growth pattern would have to be studied carefully and that such a study would have to be of a quantitative nature.

The records of twenty-one normal children were selected on the basis of excellence of roentgenograms; eleven in the 3 month to 7 year range and ten in the 6 month to 8 year range. Each series was composed of fourteen sets of head-plates taken quarterly during the first year of life, semiannually from 1 to 5 years and annually from then on. All were males.

CORRECTION OF MEASUREMENTS

In order to make absolute measurements on cephalometric x-rays, a factor of proportion may be applied, but if a great many dimensions are being taken this procedure is very costly in time. The author has accordingly devised a set of correctional scales based on the various object-film distances necessitated by heads of different sizes. Depending on the readings taken at the time the exposure is made, a scale is selected and used for all measurements on that film. These scales have been checked by Dr. Adams, Carnegie Fellow in the author's department. He compared the dimensions obtained with them from the x-ray films of dried skulls and those gained from the same skulls when mounted in a Western Reserve Craniostat, and measured according to standard anthropometric technique. The small discrepancy between the two types of measurement is not consistent and seems to be due to human error.

It seems unnecessary to describe to this audience the technique of mounting and tracing the frontal and lateral head-plates since such descriptions have frequently appeared in Broadbent's writings. The method followed subsequent to this step, however, was different from that of superposition employed in the past. Fig. 1 represents a typical tracing upon which certain points, planes, and angles have been laid out. Each line and each angle shown were measured and tabulated for every head-plate of every child. The head was divided into four areas, represented by different stipplings, and each area was first considered by itself.

1. *The Brain Case.*—This part of the head is divided from the face by two straight lines which meet at the center of the sella turcica. The anterior line, which roughly demarcates the anterior part of the cranial base, has its origin at nasion or the frontonasal junction (*N*). The posterior line demarcates the posterior portion of the cranial base and starts at the Bolton Point (*B*), which represents the height of curvature where the occipital condyle meets the squama of this bone. These two lines represent a base that is further broken into the following segments: (1) Bolton Point to the spheno-occipital junction (*SO*); (2) spheno-occipital junction to the center of sella (*S*); (3) center of sella to the spheno-ethmoidal junction (*SE*); and (4) spheno-ethmoidal junction to nasion (*N*).

Fig. 2 is a graph representing the behavior of the cranial base of the mean of these twenty-one cases from 6 months to 8 years of life. The most startling thing about it is the regularity of its progress. This is shown by the fact that after one and one-half years all of the points tend to progress along straight line courses.

Fig. 3 represents the incremental growth of the crania of two children of different types and the same striking stability is apparent. Note that the areas of unevenness remain in the same relative positions. Frontal x-rays of asymmetries reveal this most strikingly.

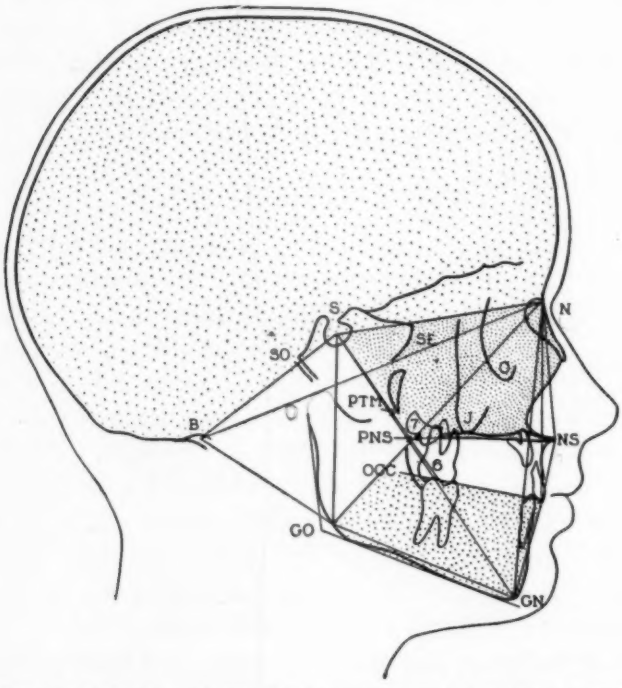

Fig. 1.—Typical tracing of lateral cephalometric roentgenogram showing points and planes used in the investigation. Variation in stipplings indicates the areas studied individually.

2. *The Nasal Area.*—In order to investigate the growth of the nose the line *S—N* is taken as a base and its length is measured for all individuals at all ages. From the point *N* a line is drawn to the anterior nasal spine (*NS*), and this line is measured. The angle *S—N—NS* is taken at the same time. The palate is represented by a line connecting the anterior and posterior nasal spines and the distance between them is read as the length of the palate. The angle *N—NS—PNS*, as well as the angle formed by the palate with the line *S—N*, is taken. An accessory measurement, i.e., the distance from the pterygomaxillary fissure (*PTM*) to the anterior nasal spine, was also read. Tabulations of these measurements, from which means were derived, gave the composite shown in Fig. 4.

On examining the composite it becomes immediately apparent that there is a striking stability in the pattern of the nasal area. While there is a slight decrease in the angle *S—N—NS* during the first six or nine months of life, indicating a relative retreat of the nose, the angle stabilizes at this time and thereafter does not change. The angle *N—NS—PNS* shows the same stability, so that the nasal floor remains constant in its relation to *S—N*, and descends from the

brain case in a parallel relation. Another interesting feature is the behavior of the point *PNS* (posterior nasal spine); it appears to advance slightly as it goes downward during the first year, but it then maintains a straight downward course. Just posterior to the points representing the posterior nasal spine will be seen the marks indicating the pterygomaxillary fissure (*PTM*), the point against which the maxilla is growing. The stable position of this point indicates the manner in which the forward positioning of the maxilla is brought about.

3. *The Upper Dental Region.*—This area is bounded above by the palate (*NS—PNS*), below by the occlusal plane (*OCC*), and anteriorly by a line connecting the anterior nasal spine with the tip of the maxillary incisor. A further

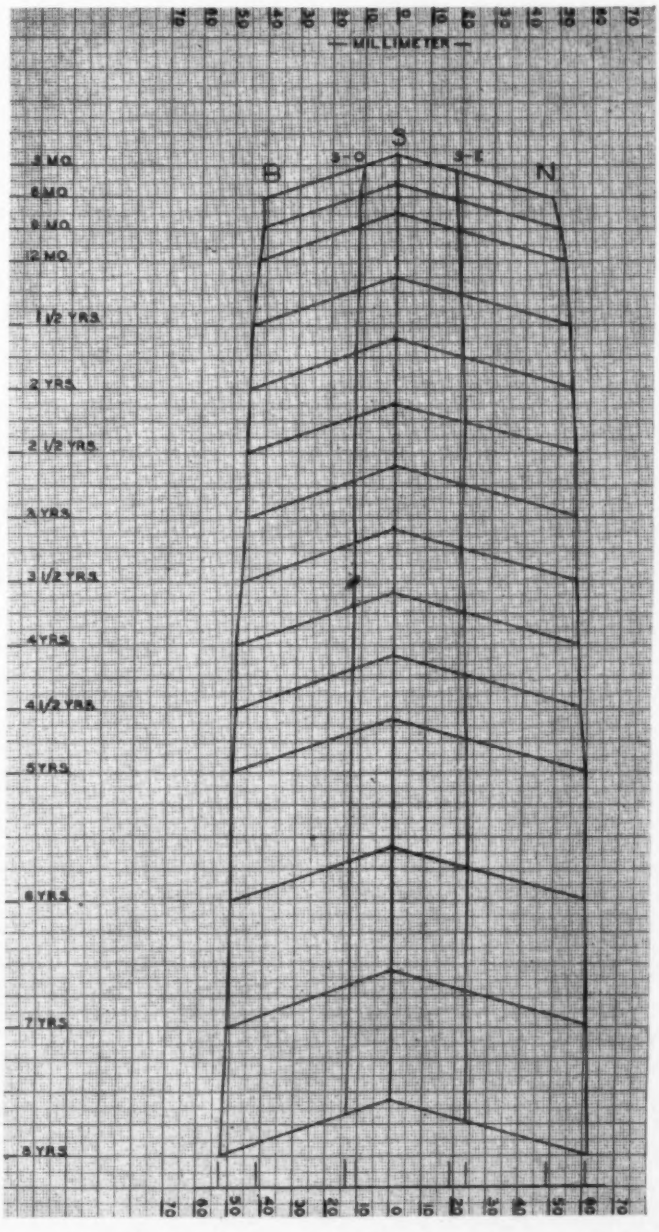

Fig. 2.—Graph representing behavior of the cranial base from 6 months to 8 years of life. Note the straight line course taken by all points.

check was made on two of these measurements. The angle formed by the occlusal plane with the line *S—N* was read in order to find the relation between them and the angle *S—N*—Upper Central Incisor, in order to study the early direction of movement of the denture. From such measurements the composite diagram shown in Fig. 5 was constructed. In this diagram it should be pointed out that since the line *NS—PNS* is descending, as shown by the first composite, it is necessary to superpose each stage upon the corresponding stage of the previous diagram. The lines representing the occlusal plane show much wider intervals, if superposing is done on a cranial base. This gives the effect of an alveolar growth, emphasized by several investigators, which is far in excess of the amount actually taking place in that area.

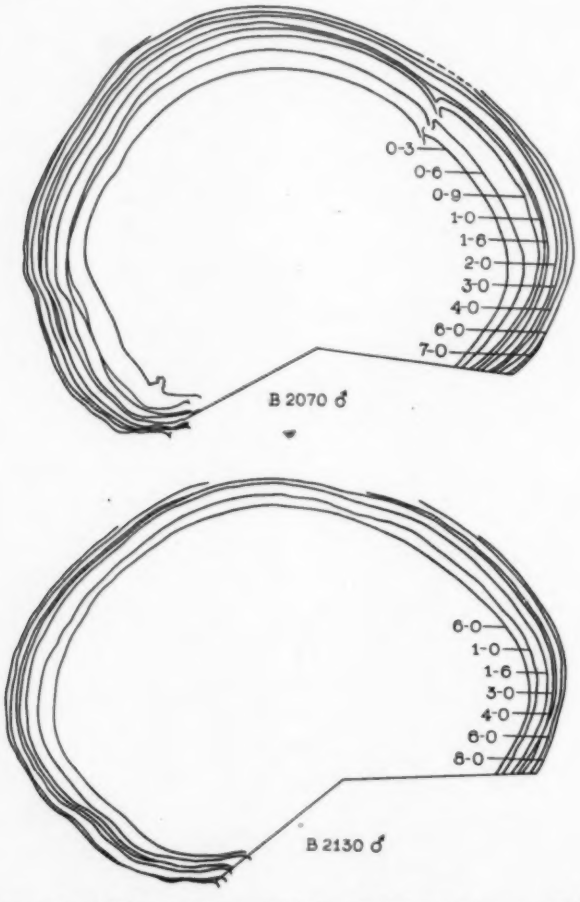

Fig. 3.—Incremental growth patterns of two children of different types. Note the persistence of early characteristics.

The first five measurements in the series, namely, those made at 3, 6, 9, and 12 months, and at 1½ years, were taken before the eruption of the second deciduous molars and therefore before the establishment of an occlusal plane. The lines projecting downward from the anterior nasal spine during this time indicate the angular relation between that point and the incisal tip of the maxillary central incisor (deciduous). It will be apparent from the increase in angulation that the forward movement of the incisal point is relatively greater than that of the nasal spine. With the eruption of the molars, as indicated by

the first line representing the occlusal plane, there appears to be a slight lag between the ages of 2½ and 4 years, after which the incisal point gains what it has lost and then seems to pass slightly the rate of the nasal spine. The last two points represent the permanent central incisor, and it will be noted that the tooth of this category slips into the path of its predecessor and proceeds in the same direction.

The composite, as well as the tabulation of the angle formed by the occlusal plane with the line *S—N*, expresses a strong tendency toward stability. If there is any deviation it is toward a lowering of the posterior end of the occlusal plane.

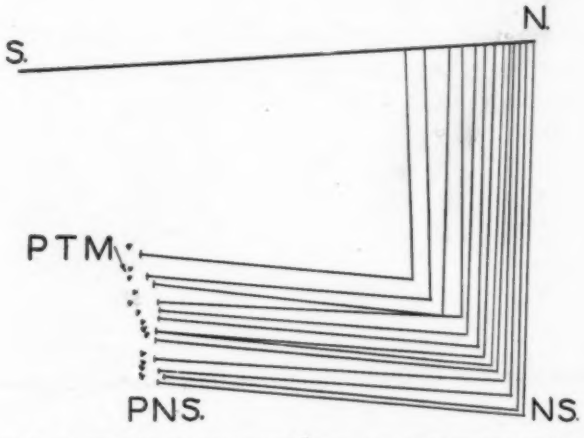

Fig. 4.—Mean composite of growth of the nasal area of twenty-one males from 3 months to 8 years of age.

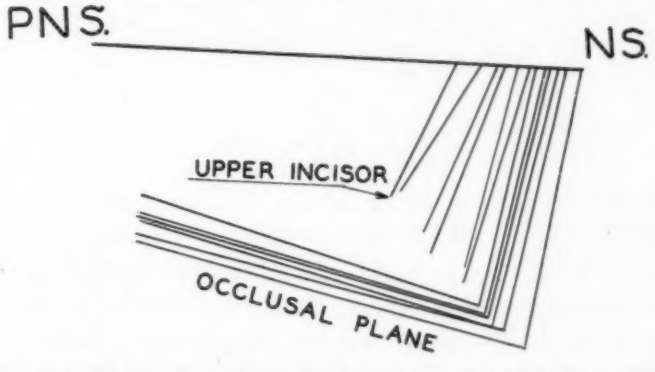

Fig. 5.—Mean composite of growth of the upper alveolar and dental area of twenty-one males from 3 months to 8 years of age.

4. *The Mandible.*—The body of the mandible was laid out in a manner similar to that employed in the upper areas, but since this bone has been studied qualitatively by numerous investigators the base selected was somewhat different.

The method of vital staining with madder and alizarin, as well as that employing implantations, has demonstrated conclusively that the greatest increment of anteroposterior growth is at the posterior border of the ramus. This growth takes in the full extent from the condyle to the angle and results in a pushing forward of the entire bone. Since this type of growth would add equally to the length of the mandible and to the anteroposterior width of the ramus,

absorption trims the anterior or coronoid border back only slightly less rapidly than deposition is taking place behind. Such slight difference in rates permits the ramus to grow slowly in this dimension. After the initial, generalized growth period has passed, the increase in height of the body of the bone is almost entirely at the alveolar border, with very little addition being made at the lower border. Thus, for this study at least, it seems legitimate to superpose on the lower and posterior borders.

Fig. 6 represents a composite of all of the cases, but owing to the lack of eruption of teeth it starts at 2 years of life. It reveals that the angles delineating its form show a constancy which is striking. It will be seen that the angle made by the occlusal plane with the lower border remains constant, although there are slight variations between stages. The most pronounced change in the entire pattern is seen at the point *GN* where the chin appears to gain on the incisal edge until 4 years. After that time even this relation seems to stabilize.

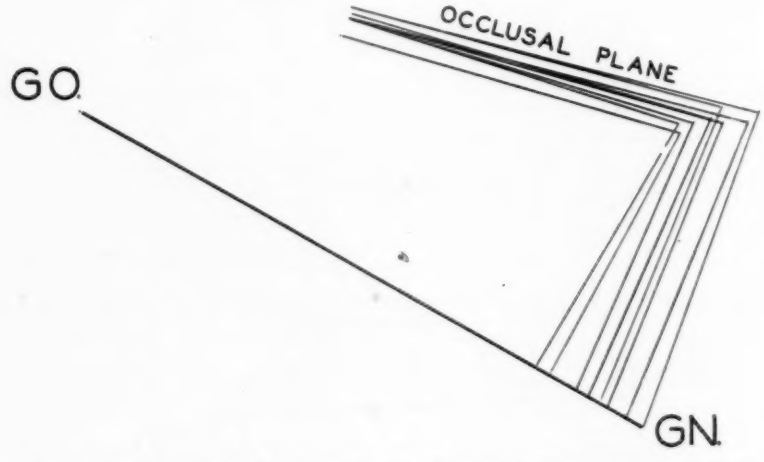

Fig. 6.—Mean composite of growth of the body of the mandible of twenty-one males from 2 years to 8 years of age.

Our final consideration of the mandible lies at the gonial angle, or junction between body and ramus. Without exception textbooks state that this angle begins as an obtuse angle, gradually closes up until adulthood, and becomes obtuse again in old age. Of all the investigators, Hellman (1927) is the only one who has questioned this point with the following remark: "The traditional idea that the angle of the jaw begins and ends with a straight line must herewith be rejected." Dealing with Indian skulls, he reveals how he arrived at this idea. "I have yet to see the mandibular angle, either of the fetus or of the senile skull, that cannot be duplicated in fully developed mandibles of certain types."

The serial x-raying of the same children makes possible the examination of the form of the gonial angle in a manner not achieved by any other method. It also discloses quite clearly how the widely held concept came to be established. If one superposes a chronologic succession of profiles of the same mandible on a tangent to the lower border at the point *GO*, it is found that the ascending ramus always meets the lower border of the body at the same angle. The condyle, however, is given off at a constantly higher level throughout the

growth period, although following a constant pattern. This explains how the error has come into general acceptance. In measuring dried skull material, the method pictured in Fig. 7, taken from Martin's *Lehrbuch der Anthropologie,* has generally been used. It will be noted that the movable portion of the goniometer is made to rest against the back of the head of the condyle and on one point on the border of the ramus. With the condyle rising with age and without any change in the angle at *GO,* it is readily evident that a smaller angle would be read on the protractor at each succeeding stage of growth. Fig. 8 represents the mandibles of all but one of the children examined. Three stages are given for each child, namely, 3 or 6 months, 3 years, and 7 or 8 years. The twenty-first child showed exactly the same condition, but the inclusion of this mandible would have necessitated further reduction of the photograph.

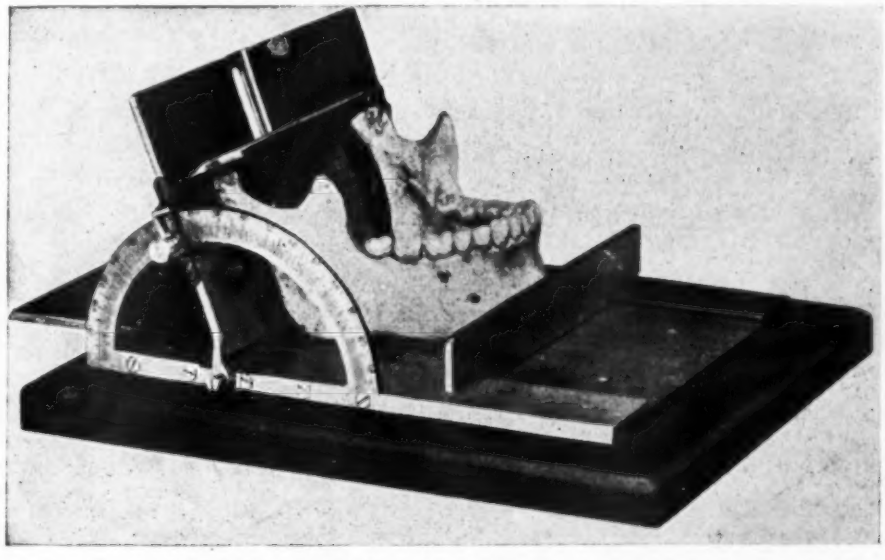

Fig. 7.—Generally accepted method employed in measuring the angle of the mandible. (From Lehrbuch der Anthropologie, Martin, 1928.)

THE FACE AS A WHOLE

At first thought it might seem that from the mere putting together of the areas already studied it would be possible to gain a clear picture of the growth of the face as a whole. But when this was done it was found that since the occlusal plane in the picture representing an early stage was higher than the nasal floor in a later one, and since a similar condition prevailed for the lower border of the mandible relative to the occlusal plane, the confusion of lines made any logical deductions well-nigh impossible. Here it became necessary to select three stages of growth, and to take the mean measurements of all angles and dimensions pertaining to each stage and draw a composite such as that shown in Fig. 9.

This figure, in addition to giving us the summation of the various composites already employed, yields several additional points. Chief among them is the parallelism between the lower border of the mandible at 2½ years and that at 8 years; further, that the nasal floor at 3 months is much more nearly parallel to the same in the succeeding stages than is the lower border of the

mandible. Moreover, we note that the distance from the nasal spine to the chin point at 3 months is proportionately much greater than at 2½ or 8 years, and that the point *GO* lies farther back. All of these apparent irregularities are easily explained.

At birth the jaws are wide apart, although the lips are closed. The tongue completely fills the mouth and protrudes over the alveolar ridges supporting the lips. In an effort to find when and how the jaws are closed, the angle formed by *S—N* with the line *GO—GN* was read and tabulated. The data disclosed that the constancy was established after 2 or 2½ years. But three cases show practically the same angles at 3 and 6 months with jaws apart as at 8 years, with jaws closed. This would seem to indicate that the mandible, while a free, floating bone, is represented in the total gross picture as an integral part of the face. Not only is its own form predetermined but also its part of the facial pattern, even before the teeth have erupted. Its relation to the upper face at an earlier age is apparently dependent upon the tensions of the muscles above and below it. During this portion of its growth the tongue is relatively

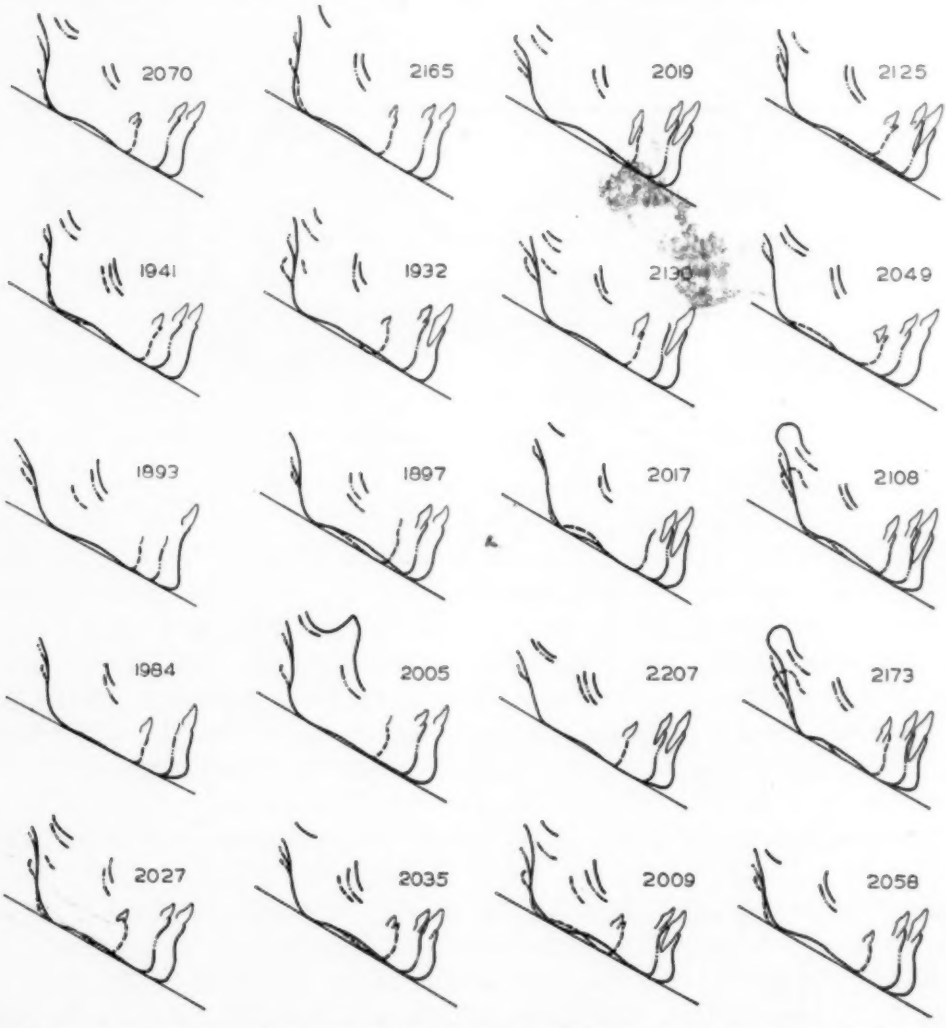

Fig. 8.—Growth patterns of twenty males from 3 months to 8 years of life as shown by superposition.

larger than the jaws, i.e., closer to its proportions in the adult. That organ is gradually enclosed, not by the shutting together of the jaws, but by the growth of the alveolar processes (downward in the upper and upward in the lower), together with eruption of the teeth. Such growth takes care of the vertical dimension. The anteroposterior increase, on the other hand, is achieved by rapid accretion on the posterior border of the ramus and absorption on the anterior border, with the condylar head remaining relatively fixed in the glenoid fossa. All of this results in a forward positioning of the mandible, while in the maxilla the same growth posteriorly takes place at the tuberosity. The latter, buttressed as it is against the pterygoid processes of the sphenoid, leads to a forward positioning of the maxilla.

If now we imagine the mandible in Fig. 9 swung up to parallelism with that in later stages, four conditions are changed: (1) parallelism is established between the mandibular borders; (2) the distance between the nasal area and that from the palate to the chin point becomes proportional with that in the succeeding stages; (3) the point *GO* is carried to a position anterior to the two older ones, and on a straight line with one connecting them, and (4) all of the *GN* points fall on a straight line.

All of the foregoing is concerned with composites derived from mean dimensions and mean angles. It can therefore be accepted only as indicating general trends and tendencies. The next effort was devoted to a scrutiny of individual cases with the aim on determining how closely the individual conforms to average behavior.

THE INDIVIDUAL PATTERNS OF GROWTH

In order to obtain as striking a contrast as possible between cases, these were sifted according to the various angles. Angle *S—N—GN* appeared to give the most promise, and two cases were selected, one of which showed the greatest angle and the other the smallest angle.

Fig. 10 shows these two extremes superposed on the composite of the means, a portrayal which indicates some of the advantages of dealing with angles instead of with linear dimensions. The nasal floor is seen to be almost parallel in these cases, the occlusal plane less so, and the mandibular border least of all. The discrepancy in absolute size between the two extreme cases led to a search which resulted in Fig. 11. That figure represents two cases having identical *S—N* distances, and brings out two distinct types. Furthermore, we see that the nasal floor and the occlusal plane are pulled, as it were, in the direction of the typal pattern. At the same time, a scrutiny of the angles of each of these cases taken individually will reveal a constancy of pattern throughout the growth period embraced by this study.

PROPORTIONALITY IN THE GROWTH OF THE FACE

Much has been written about the percentual increase in the growth of the various parts of the face. To survey quickly the possibilities of significant findings, the writer constructed the graph shown in Fig. 12. The chronologic table is given at the bottom, while the straight line at the top represents the point N. From this line perpendiculars were dropped at each age, and the mean increments of the various lines were laid off. Thus, the second line represents the

progress of the anterior nasal spine, the third line that of the upper central incisor, and the fourth line that of the chin point *GN*. A glance is sufficient to reveal the fact that after 1 or 1½ years all points tend to progress on straight lines. This observation is expressed more graphically in Fig. 13, where the growth processes of three different cases are shown.

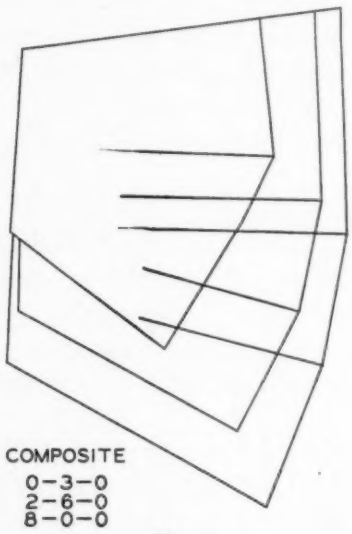

Fig. 9.

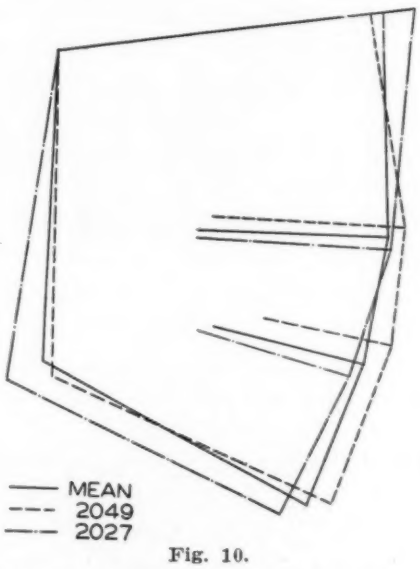

Fig. 10.

Fig. 9.—Mean composite of the total facial patterns of twenty-one males at 3 months, 2½ years, and 8 years of age.

Fig. 10.—Superposed patterns of cases exhibiting extremes of the angle *S—N—GN* on the pattern of the mean (8 years).

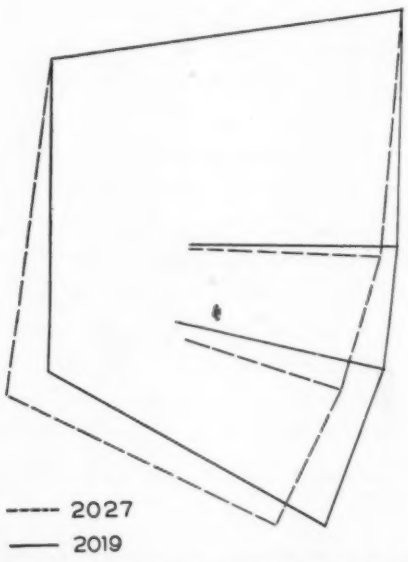

Fig. 11.—Superposed patterns of two cases having identical *S—N* dimension. Note the difference in type.

The nose seemed to show such stability in pattern and in growth that an effort was made to determine the proportional extent of its contribution to growth. It was found that after 1½ or 2 years of life it constituted 43 per cent of the total height of the face in the growth range represented by the present study. The range in percentage was so narrow that curiosity impelled a search

into different ages and conditions. Dr. Thompson, a graduate student, found a mean of 43 per cent, ±.8, while Dr. Stapf, another graduate student, obtained an identical mean from forty malocclusions belonging to the Class III type. It is interesting to note that Brash, comparing the skull of a newborn infant with that of an adult, gave 41.3 per cent for the former and 42.85 per cent for the latter.

THE GROWTH PATTERN AND THE TEETH

As the stability of the facial pattern began to force itself upon us, it was but natural that an orthodontic department should become interested in the behavior of the teeth. Ever since the introduction of the Angle Classification in 1899 a controversy has raged over the propriety of the use of teeth as relatively fixed points. A series of investigations on this phase of study were accepted as subjects for Masters' theses by several graduate students. The findings obtained were very enlightening.

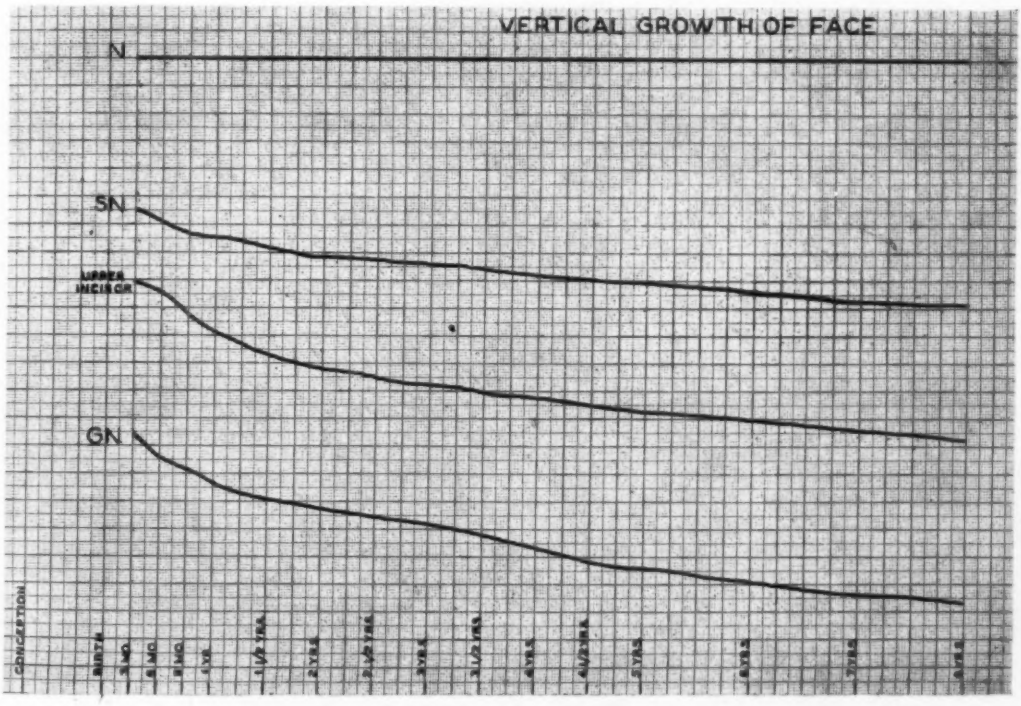

Fig. 12.—Graph portraying growth progress of four points on the profile of the face, viz., nasion, anterior nasal spine, upper central incisor, and gnathion.

Adams undertook an appraisal of the mandible in the three classes of malocclusion. Among these were fifty-four of Class I and fifty-four of Class II cases. His findings strongly indicated that there were no essential points, either in absolute size or relative proportions, that would distinguish one from the other. This study indicated that the typical tooth relationship of Class II was not the result of underdevelopment of the mandible and made it necessary to examine two other possibilities, viz., whether the maxilla was forward of normal or the mandibular teeth were posterior in relation to the body of the mandible.

The latter problem was attacked by Elman, whose report has just been published. He found that if measurements of the distances between the distal con-

tact point of this tooth to the posterior margin of the mandibular ramus were taken on a line parallel to the occlusal plane, and another was taken from the same tooth point on a perpendicular to the lower border of the mandible, he obtained a 3 to 2 ratio. An angle representing this ratio on graph paper gave a mean of 34.51° for Class I and 34.30° for Class II, a difference of only .21°. The standard deviation for the first was .94° and for Class II 1.22°. These findings seem to prove conclusively that the relation of the lower first molar to the mandible is the same in Class I and Class II. Thus the problem resolved itself into a question of whether the mandible was posterior or the maxilla anterior in Class II malocclusions. Neither of these men separated Class II into its two divisions, an oversight that we are beginning to regret.

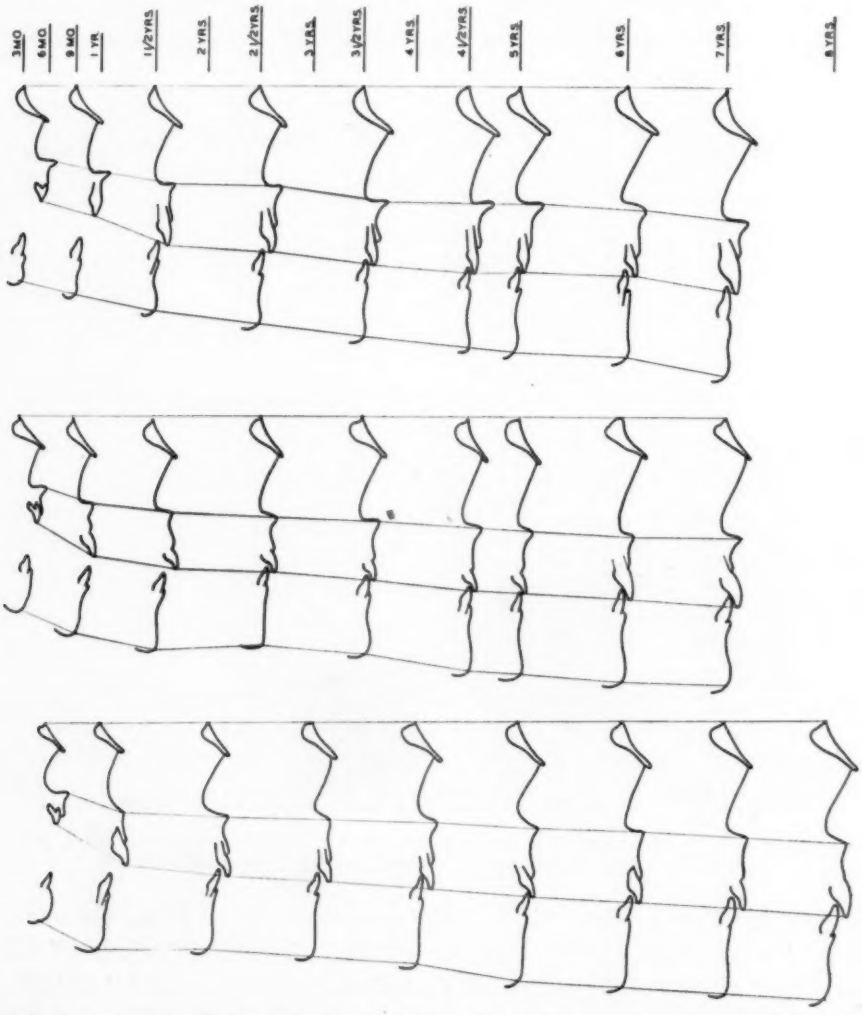

Fig. 13.—Progress of growth of anterior facial height in three cases selected at random.

The maxillary first molar is not susceptible to measurements from two points in the maxilla in a radiographic technique but the angular attack employed by Elman suggested that a similar approach might be used here.

The line *S—GN* had proven itself very constant and the angle *N—S—GN* was found to be stable in the individual. The behavior of the maxillary six-

year molar in relation to this line was very striking. It was found that the angle formed at *S* by the line *S—N* to one running from *S* to the notch between the mesial and buccal cusps opens steadily until the molar goes into occlusion with its antagonist. By this time it has opened to within one and a half degrees of *N—S—GN* (it may be identical), but henceforth that relation does not change and the tooth is found on the line up until 8 years. This relationship was found to persist in children of later age ranges and in adults.

Baldridge undertook to examine, cross-sectionally, the relation of the six-year molar and the angle *N—S—GN*. He divided his material into Class I, Class II Division 1, and Class II Division 2. A tabulation of the angles obtained for the six-year molar yielded means of 67.95° for Class I, 68.47° for Class II Division 1, and 67.86° for Class II Division 2. Note that these vary only slightly, one from the other. The angle *N—S—GN* gave the following means: Class I—68.95, Class II Division 1—70.86, and Class II Division 2—68.86. Note here that Class I and Class II Division 2 are very close together, while Class II Division 1 shows a wider angle. Since the mandibular molar is correct in its relation to the mandible it would seem that the entire bone in Class II Division 1 was posterior to the maxilla. In Class II Division 2, on the other hand, the similarity in the angle *N—S—GN* to that obtained in Class I and the close approximation between them of the angle *N—S—6* would indicate that in this anomaly the mandible was normal in its relation to the cranium, a point made by Hellman in 1931. The frequent appearance of a bony shelf at the chin point in these cases further strengthens the idea that the mandibular teeth and alveolar arch are posterior to their normal relations.

Thus it is seen that all studies thus far made have indicated that the maxillary six-year molar is not the will-of-the-wisp it has been called. It consistently yields the lowest standard deviation of any of the facial measurements.

To summarize briefly the material thus far covered it is possible to state that a longitudinal study of growing children indicates that the morphogenetic pattern of the individual is established at a very early age and that once attained it does not change. The employment of angles and angular relations in the place of linear dimensions has been shown to be of advantage in several ways: (1) It eliminates differences which are due to absolute size. (2) It permits a more accurate allowance for the differences introduced by type. (3) It makes possible more satisfactory comparisons between the patterns of animals and that of man. (4) It reduces to a minimum the need for fixed points as bases of comparison.

The plotting of growth increments, a part of the work not referred to here, reveals a series of gradient curves which indicate that every part and probably every bone is growing at a constantly diminishing rate. These various growth rates, however, are so integrated, one with the other, that the progress of any anatomic point is always along a straight line.

The teeth, and particularly the maxillary first permanent molars, have been shown to assume relations that are among the most stable in the face. It is still possible to classify according to the relations assumed between them and their mandibular antagonists.

QUALITATIVE STUDIES

And now before closing I should like to refer briefly to the qualitative aspect of the study. Some three years ago, the spectacular results obtained with Alizarin Red S, by Schour and his colleagues, led to the formulation of a program of study on growth through a combination of methods. No single method will yield all of the answers sought, and it seemed possible that a combination of a quantitative and a qualitative attack should produce results unattainable with either alone.

For the perfection of the techniques involved in this phase we are indebted to Dr. Schour, Dr. Hoffman, and Dr. Massler. Dr. Spence has widened the scope of investigation with a combined study on the albino rat, using both alizarinization and serial roentgenology. For the latter purpose he has had to design a separate cephalometer capable of yielding accurate data on small animals. By modifying the ear posts of the Broadbent-Bolton cephalometer it has been possible to employ this equipment on the macaque monkey. Groups of growing animals are injected and x-rayed at regular intervals. Upon sacrifice of the animal both quantitative and qualitative appraisals are made. Although this work has been under way for almost two years it is too early to make more than a few cautious statements at present.

The chief finding is that very early growth is generalized; that is, all of the surfaces seem to be increasing in size. At relatively early ages this picture dies out and there are left only certain sites which continue for varying periods thereafter. These sites are not in the nature of separate phenomena. They have been present from the start and have probably been growing at a higher rate right from the beginning. They become noticeable, however, only when other parts stop.

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THE RECORD OF HEALTH

CARL C. FRANCIS, M.D., CLEVELAND, OHIO

WHAT is a healthy child and are there objective measures of health? At the present time there are at least partial answers to these questions.

Popular magazines and scientific journals are full of articles on various aspects of health and growth, and the interest of both the scientific investigator and the layman is keener than ever before. In many investigations certain basic facts have been assumed as axiomatic, and only a few foundations are really doing fundamental research. Too often the absence of actual disease has been assumed to be health. Such a negative definition is not enough.

The Brush Foundation was endowed by Charles Brush and planned by Dr. T. Wingate Todd to study the growth and development of the well born child. Studies on dentofacial growth coordinated with the Brush studies have been made possible through the generosity of the Honorable Frances P. Bolton and her son, Charles, and are under the direction of Dr. B. Holly Broadbent. Contributions have been made by others, including the Cleveland Foundation, the Allergy Foundation, and the General Education Board. The organization is housed in rooms supplied by the Department of Anatomy of Western Reserve University.

The children selected for the study come from homes of a stable socioeconomic level in Cleveland and are free of any gross mental or physical defect. Each is under the regular care of a physician. The children are not merely free of actual disease and obvious mental or physical handicaps, but are children well endowed by birth and given every aid known to modern medical science to insure health and vigor. They are in a state of positive health.

The developmental health examination as carried out by the Brush and associated foundations enables us to say with assurance what is the expected rate of healthy growth in dimensions, maturity, and mental expansion. We are gradually learning the interrelationships of these various measures of progress and how each is affected by illness or accident.

Many of these children have now been observed for ten years, and we already have completed standards of progress in height and weight and in bodily maturity. Our children are all assessed upon our own standards, and therefore every child is compared with the average for children in the same general environment.

The standards on height and weight were published by Simmons and Todd in 1938, and the *Atlas of Maturation of the Hand* by Todd has appeared.[1, 2] The remaining atlases for the other portions of the skeleton are as yet unpublished.

From the Department of Anatomy and The Brush Foundation, Western Reserve University, Cleveland, Ohio.

Read before the American Association of Orthodontists, Chicago, May, 1940.

I believe that the rate of progress is more significant than the actual increase. A boy or girl who advances steadily year after year in stature and in weight is usually the one with the health record which is free of any serious illness or accident.

In Fig. 1 the average rate of increase in height, weight, and bodily maturity is shown in solid black lines and the progress of a single boy (SS 924) is shown in broken lines. Note how closely he has followed the average in all three measures for a period of ten years. He has had no serious accidents or illnesses and may be certified to be a healthy boy.

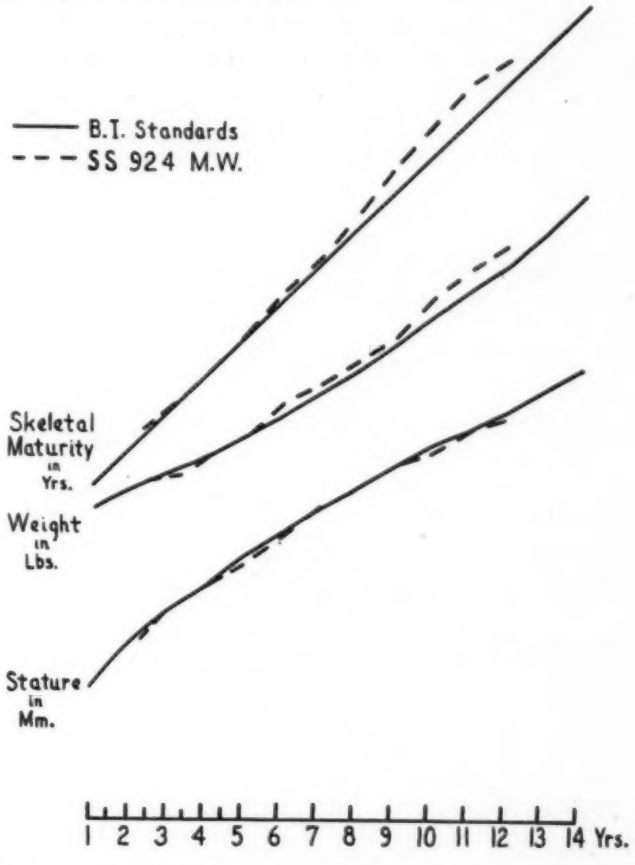

Fig. 1.—Chart of a boy showing an average rate of growth and physical development. In height, weight, and bodily maturity his progress has been very close to the standards for a period of ten years.

In Fig. 2 is shown the progress of a boy who has been growing steadily but slowly (SS 3089). It is true that he is below our average in height, weight, and bodily maturity, but progress is satisfactory and merely because he is small there is no reason to believe that he is less healthy than a larger boy.

Children who are obviously well grown do not constitute a diagnostic problem from the standpoint of progress and neither do the really sick children. But the borderline case is very difficult to classify, and, of course, it is in such children that an early decision is most essential. The only reliable criterion, in my estimation, is successive examinations at regular intervals in order to get the trend. No simple measure gives enough information to make any final decision.

In Fig. 3 the progress of a boy (SS 4337) during his first two years is shown. Note how he deviates from the average in each measure. In weight he is sometimes below and sometimes above. In height he gradually falls somewhat below, and in bodily maturity he is far below average at two years. A casual inspection of the child at this age does not reveal any startling deviations, but in view of the erratic progress our prediction for future progress must be guarded.

In addition to giving us the state of bodily maturity the roentgenogram also gives valuable information concerning the level of mineralization in the bones, the quality of muscles, and condition of subcutaneous tissues and skin. Changes in these structures give objective evidence of disturbance to health.

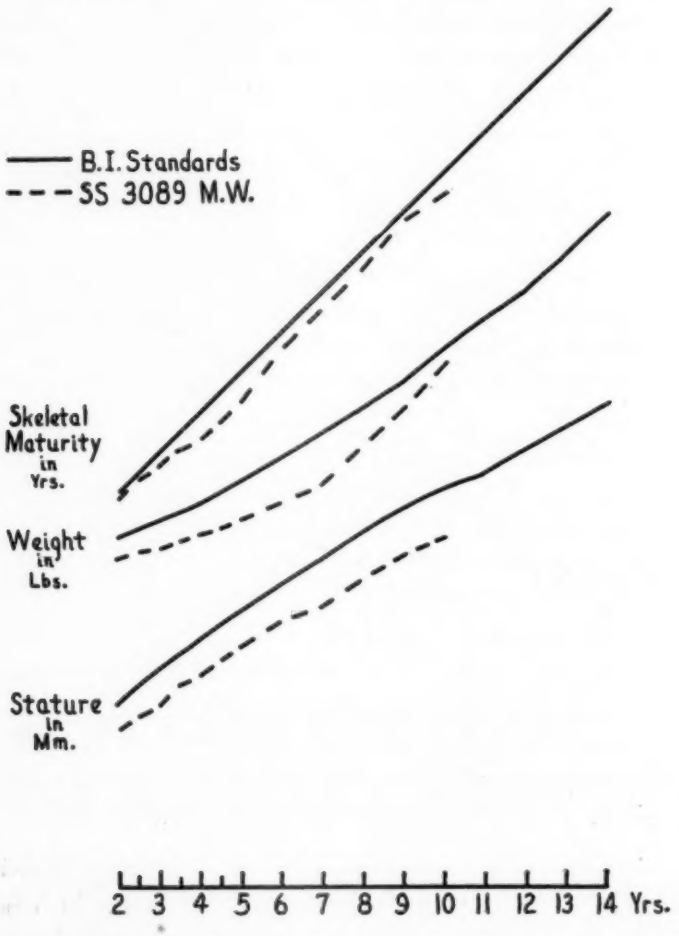

Fig. 2.—Chart of a boy showing slow growth and physical development. His progress has been steady but he remains below average for his age at each examination.

In a growing child any disease producing a severe constitutional reaction such as pertussis or pneumonia will leave a scar of interrupted growth. This is a sharp, well-defined, transverse band of denser bone visible near the growing end of each long bone. It disappears within a few months or a few years. But while it remains it is an objective record of a single disturbance. If an illness does not produce a visible scar, one of two things is true. Either the

disturbance to the general constitution has been minimal or the child is not growing. Harris has discussed these scars at considerable length.[3]

Children suffering from prolonged or chronic, mild gastrointestinal disturbances often show many, fine, irregular, transverse markings on the roentgenogram. The lower end of the tibial shaft is a good area in which to look for such scorings (Fig. 4). In our experience these are particularly apt to be found in young children suffering from gastrointestinal allergy. If such allergy is overcome within a fairly short time, no other disturbance to growth may be found, but if it is prolonged the child fails to gain in weight; then he begins to grow more slowly in stature, and finally to lag in bodily maturity. The disappearance of these scorings is evidence of the overcoming or submerging of the gastrointestinal sensitivity. Cohen and others have published papers discussing the relation of these scorings to allergic children.[4]

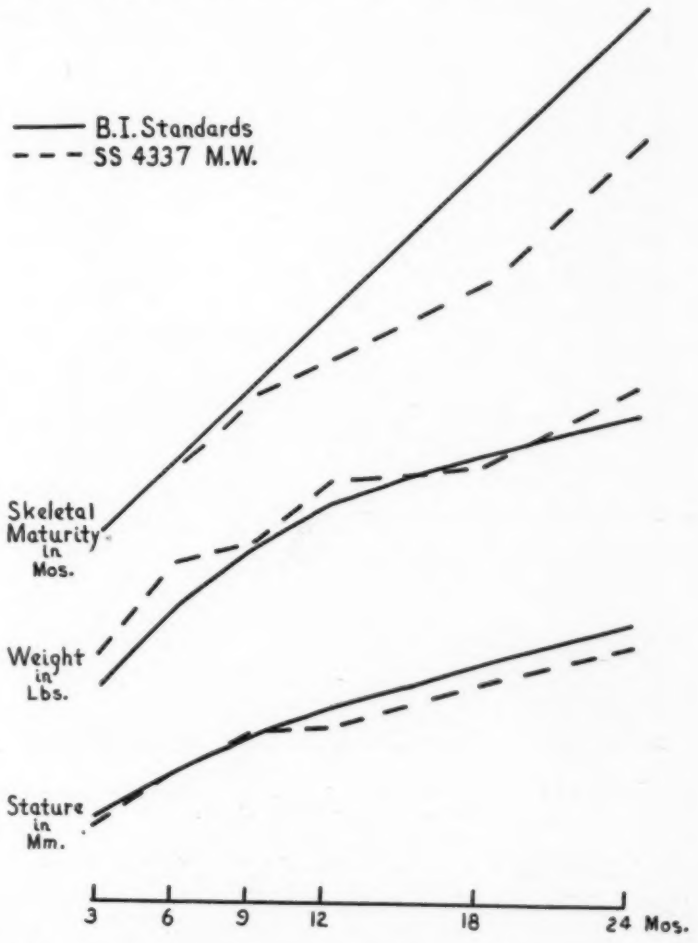

Fig. 3.—Chart of a boy showing erratic growth and physical development. In weight he is sometimes above and sometimes below average. As he grows older, he tends to fall farther behind in stature and skeletal maturity.

The density of bone and muscle shadows gives us information of the level of mineralization.

In Fig. 5 are shown the roentgenograms of two girls at the same level of physical maturity, about 13 years. In the girl *A*, the bones are richly mineral-

ized and cast sharp, well-defined shadows. In the other girl, *B*, the bones are low in mineral, and the shadows are ill defined, particularly in the carpal area. Identical technique was used in taking these two films; therefore, the obvious differences are due to differences in degree of mineralization. The girl *A* is large and well developed for her age; she has an abundance of energy, does well in school, and takes an active part in many extracurricular activities. The girl *B* is small for her age, immature, and has no reserves of energy. She is mentally normal but has difficulty in school because she fatigues easily and finds it difficult to concentrate. She has no strength to take part in any extracurricular activities.

Fig. 4.—Roentgenogram of the left ankle of a boy of 5 years. Numerous scorings are visible on the lower tibial shaft.

During periods of very rapid growth, shadows of bone spongiosa frequently become lighter, and become denser after growth ceases. We interpret this as meaning that mineral is withdrawn from the stores in the spongiosa to be built into the rapidly growing ends. Muscle shadows frequently become lighter also. This is a physiologic type of drainage and is often accompanied by lowered muscle tone expressed in poor posture and lowered foot arches. The adolescent boy is not actually lazy. His attitude is merely the result of physiologic demands.

Subcutaneous tissue shadows should be moderately thick and clear enough that blood vessels ramifying in the area may be followed, and the skin shadow

should be distinct. Temporary fluctuations in fluid balance do lead to variations of density of subcutaneous tissue shadows and of weight. If we are following a child who suddenly puts on a great deal of weight and at the same time shows increasing density of subcutaneous tissue shadows, we must interpret the increase as being in part, at least, due to temporary fluid retention. The rapid changes in weight of allergic children fall into this group.

It is not necessary to discuss the severe and permanent disturbances to health which produce permanent alterations in the growth pattern. These are

Fig. 5.—Roentgenograms of the left hand of two girls at the same level of physical maturity. The bones of *A* are well mineralized and cast distinct shadows. The bones of *B* are poorly mineralized and cast indistinct shadows.

obvious and any therapeutic or surgical measures are palliative and not curative. Children suffering from achondroplasia, acromegalia, cretinism, feeblemindedness, and similar conditions can never be made into completely healthy individuals.

The growth of the face and jaws is, of course, the particular interest of orthodontists. The combined studies of the Brush Foundation and of the Bolton Fund are yielding much valuable information concerning the relationships of facial growth. If growth in general is stunted or retarded due to illness, the growth of the face is also affected and curiously enough the forward adjustment is more apt to be interfered with than is the vertical growth.

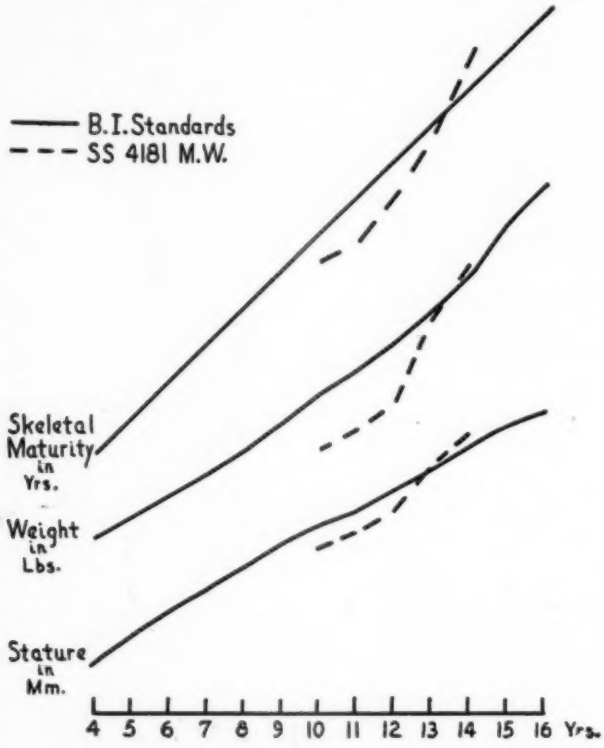

Fig. 6.—Chart of a boy showing acceleration in rate of growth and development. At 10 years he is below average in height, weight, and bodily maturity. At 14 years he is above average in all three measures.

In Fig. 6 is shown the general growth of a white boy (SS 4181) who was below average when we first saw him at 10 years. The mother was very ill before his birth, and he was a severe feeding problem in infancy. He had whooping cough, measles, mumps, and chicken pox before he was 6 years old. At the time of his first visit he was below average in height, weight, and bodily maturity, but from this one examination it would be impossible to tell whether we are dealing with a healthy, slow development or with actual retardation. The health record strongly suggests the latter.

During the next four years he was free of any illness and he has grown rapidly so that at 14 years he is above average in height, weight, and bodily maturity. This boy was fundamentally a vigorous grower, and as soon as he overcame the handicap of his early illnesses he displayed his true potentialities.

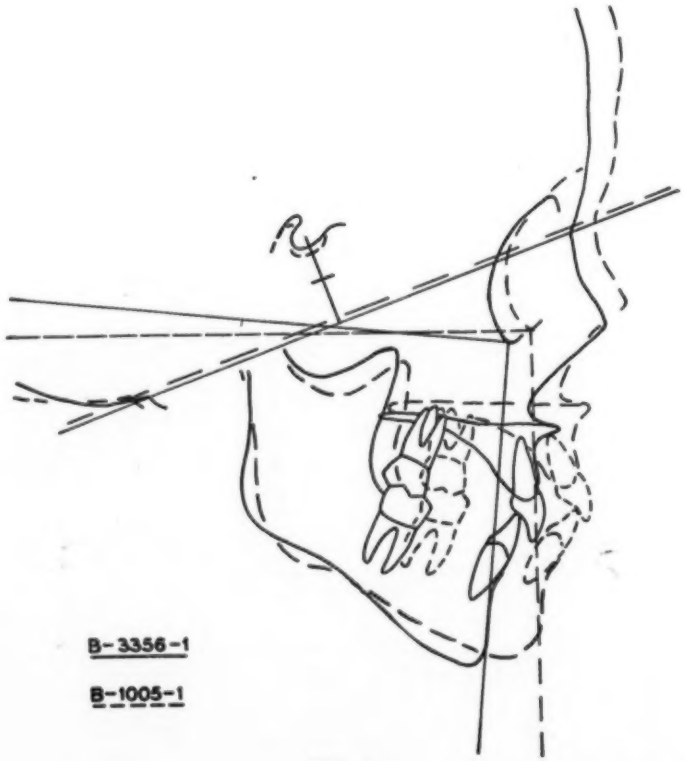

Fig. 7.

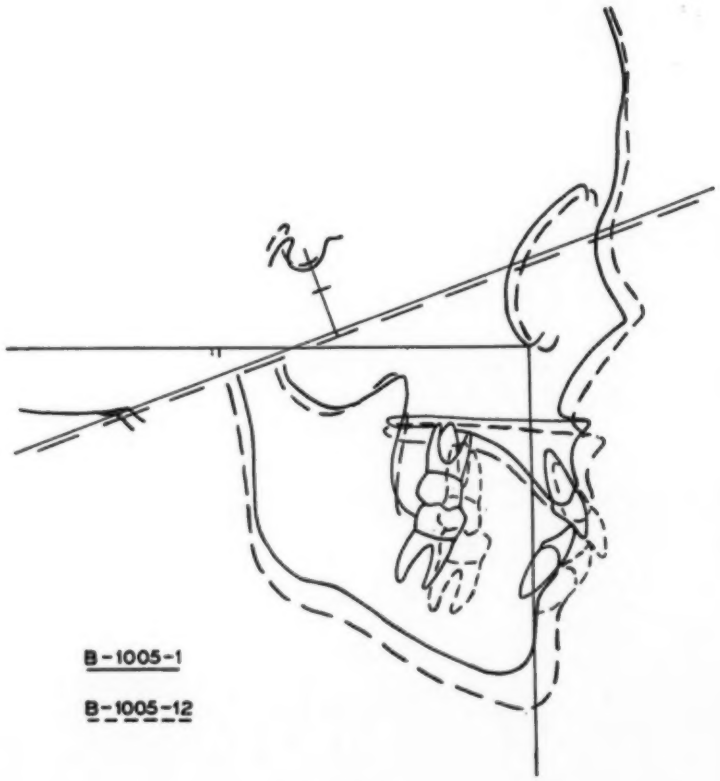

Fig. 8.

Fig. 7.—Profile of retarded facial growth. These are tracings of lateral roentgenograms made on a Broadbent-Bolton Roentgenographic Cephalometer. The solid outline shows the facial size at 10 years of a white boy who had had many illnesses during the first 6 years of life. The broken outline shows the usual facial size for 10 years. Vertical growth has not been held back but forward adjustment has been.

Fig. 8.—Profile of healthy facial growth. The solid outline is that of the Bolton standard for male white at 10 years and the broken outline that at 14 years.

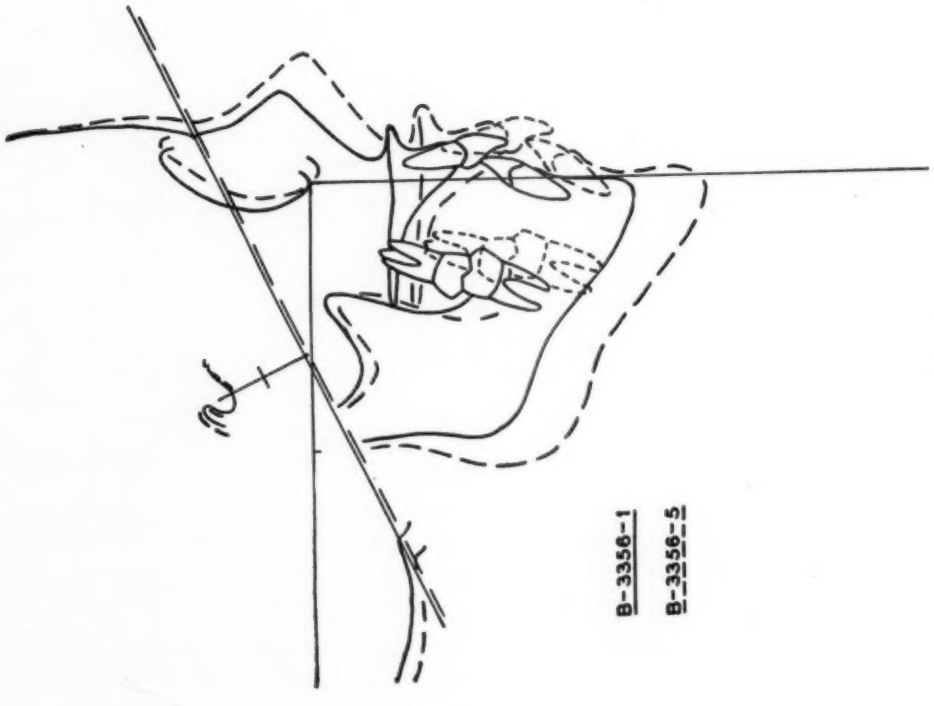

Fig. 9.

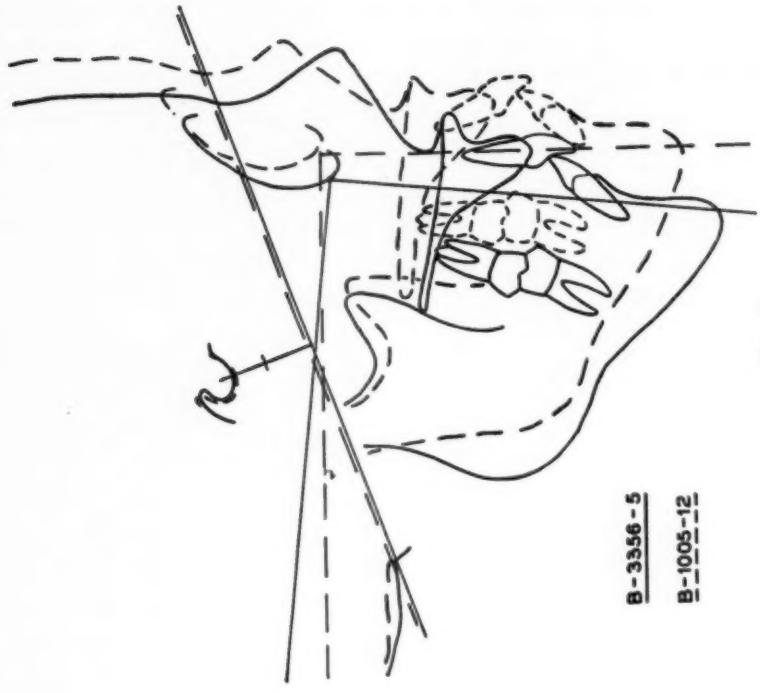

Fig. 10.

Fig. 9.—Accelerated facial growth. The solid outline shows the size of the face at 10 years, and the broken outline the size at 14 years. By comparison with Fig. 8 the boy's face has grown more than the expected amount.

Fig. 10.—Comparative facial size at 14 years. B 3356-5 is still not up to the Bolton standard (B 1005-12) for 14 years in forward adjustment of the face. See text for further discussion.

Let us examine the facial growth of this same boy during the same interval. I am indebted to Dr. B. Holly Broadbent and Dr. John W. Richardson for the analysis of dentofacial growth.

In Fig. 7 are superimposed the facial profiles of the boy under discussion (B 3356) in solid outline and that of the Bolton standard for ten years in dotted outline. Vertical facial growth has not been retarded but forward growth has been held back, and the difference is particularly marked in the mandible.

In Fig. 8 are superimposed the Bolton standards for 10 years and 14 years, and in Fig. 9 are superimposed the profiles of B 3356 at 10 and 14 years. He has grown more rapidly than the average child particularly in forward growth of the face and is therefore making up for his earlier retardation. In Fig. 10 are superimposed B 3356 and the Bolton standard for 14 years showing that his forward facial growth is not yet up to average for his age, but if he continues his present rate of progress we may certainly predict still further improvement.

In a healthy child growth and development are harmonious. In caring for any individual whose progress has been warped or retarded as a result of illness, it is not enough to treat the local manifestation. An appraisal of the effect upon the entire structure is needed in order to give efficient treatment.

The orthodontist cannot hope to attain the best results if the child remains sickly. Advantage should be taken of the fact that with improving health nature tends to correct existing deformities. The developmental health examination in which various aspects of growth are studied is the best measure of the health of the child.

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LATERAL HEAD ROENTGENOGRAMS AND THEIR RELATION TO THE ORTHODONTIC PROBLEM

L. B. Higley, D.D.S., Iowa City, Iowa

UNDOUBTEDLY most orthodontic failures may be traced to incorrect diagnosis, empirical treatment, or both. The majority of orthodontists now realize that similar malocclusions of the teeth are not necessarily found in similar face or skull architectures nor in similar relationships to the rest of the head.

Correctly oriented roentgenograms of the head have been an outstanding contribution to such realization; have served as an important aid to diagnosis, and have made it possible to analyze the changes that occur during and subsequent to orthodontic treatment. Such analysis may be the means of diminishing the amount of empirical or rule-of-thumb treatment that is admittedly being practiced at present.

The method of procuring the head roentgenograms, now to be demonstrated, will not be new to many of you. The equipment, in its essential features, is similar to that used by Broadbent,[1] who first initiated the use of such roentgenograms in this country. This particular equipment, however, obviates the need for two x-ray tubes in order to procure both the profile and anteroposterior roentgenograms, since the head holder may be rotated to allow for both positions of the head in correct relationship to the film and target. This demonstration and discussion will be confined to the lateral head roentgenograms.

The head positioner and casette holder in this particular setup are supported by a wall bracket, Fig. 1, and when not in use are swung back against the wall. The patient is seated in the lowered dental chair (or any chair that may be raised), the x-ray tube, if not permanently aligned, is carried to position and the head positioner swung to place over the patient. The head positioner and x-ray tube can and must come to rest each time at exactly the same place as previously determined when installed. The chair is now raised until the patient's ear holes are on the same plane as the ear rods of the head holder. The head is then oriented on the Frankfort plane by carrying the ear rods into the ear holes and tipping the head so that the eye pointer touches the lowest point in the lower border of the right bony orbit. The nasion support is now carried to position and tightened securely, after which the eye pointer is raised out of the way. The film, contained in a casette, is now placed in the casette holder, carried to place against the left side of the face, and squared parallel to the midsagittal plane of the head at right angles to the midcentral ray of the x-ray tube (Fig. 1). After exposing and developing correctly, the resulting roentgenogram reveals the osseous structures and teeth of the head in good detail (Fig. 2*B*).

Nevertheless, it is difficult to see much resemblance to the patient, since the soft tissues of the profile are blacked out due to overexposure. To over-

Read before the Thirty-Eighth Annual Meeting of the American Association of Orthodontists, Chicago, May 13 to 16, 1940.

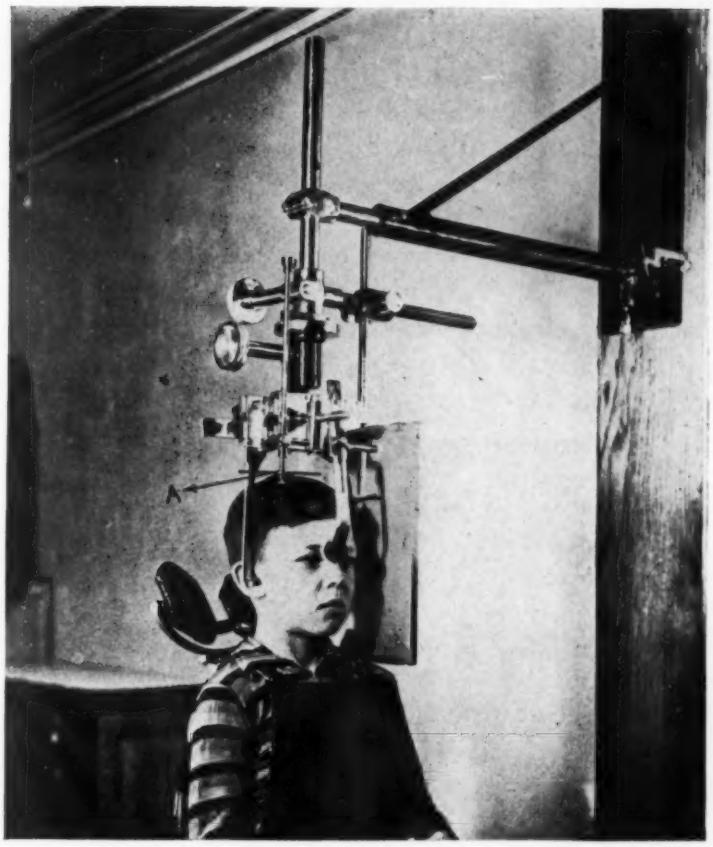

Fig. 1.—Head positioner and casette holder supported by a wall bracket. *A*, the orbital pointer raised after the head is oriented on the Frankfort plane.

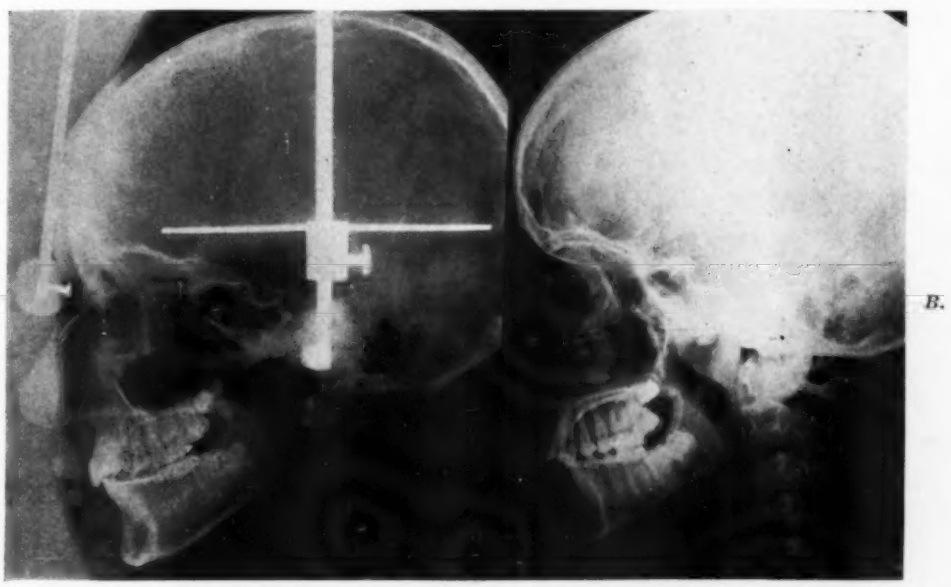

Fig. 2.—*A*, Profile roentgenogram produced using the lead masking device. *B*, profile roentgenogram produced without the use of the lead masking device.

come this the author, several years ago, evolved a very simple method for the simultaneous production of both hard and soft tissues in profile radiography.[2] This consists of placing in front of the x-ray tube a lead diaphram in which there is a small aperture positioned directly over the target. If the anterior edge of the aperture is correctly located for each patient the soft tissue of the profile is partially masked with lead, resulting in its being exposed less than the rest of the head (Fig. 2). As a result of this Wester of the Ritter Dental Equipment Co.[3] has recently worked out a method for accurate positioning and masking of their dental x-ray unit (Figs. 3 and 4). The lead masking device passes through the cone of the x-ray unit and is calibrated so that the positioning of the aperture for various head depths is simplified. Wester has worked out a formula for the proper setting of this lead masking device which

Fig. 3.—The Ritter Dental Equipment Company's support for accurate positioning of their dental x-ray unit.

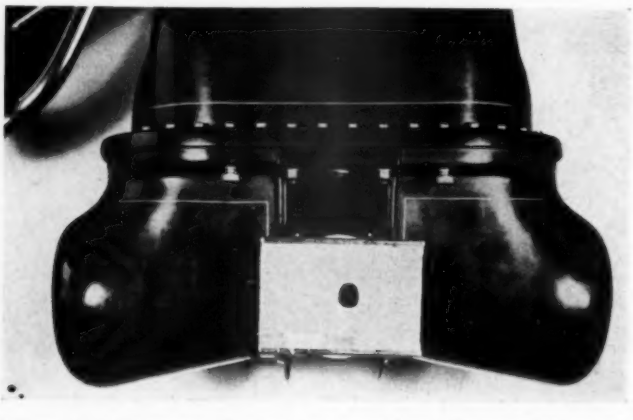

Fig. 4.—The Ritter Dental Equipment Company's masking device used with their dental x-ray unit to obtain soft and hard tissues simultaneously in profile roentgenography.

is also an index for the exposure time. This is based on the measurement taken from a plane through the center of the ear rods to one at the bridge of the nose. "Each inch of that distance represents one second of exposure time at 15 milliamperes to the total of which one-half second is added; thus, if this measure reads three and one-half inches, the exposure time would be three and one-half plus one-half, or four seconds. This has given good results and tends toward roentgenograms of uniform color and density."[3]

ADVANTAGES OF OBTAINING HARD AND SOFT TISSUE PROFILES SIMULTANEOUSLY

There are obvious advantages in showing the correlation between hard and soft tissues. For example, contrast the roentgenograms in Figs. 5*A* and *B* which are of 14-year-old girls having rather typical Class II Division 1 (Angle) or lower dental retraction (Simon) types of malocclusion. As may be seen, the one with the greatest amount of overjet, Fig. 5*A*, presents the least amount of deformity in the lower third of the face. Viewing the patient, her photograph, or the usual profile roentgenogram, would not indicate the reason for this.

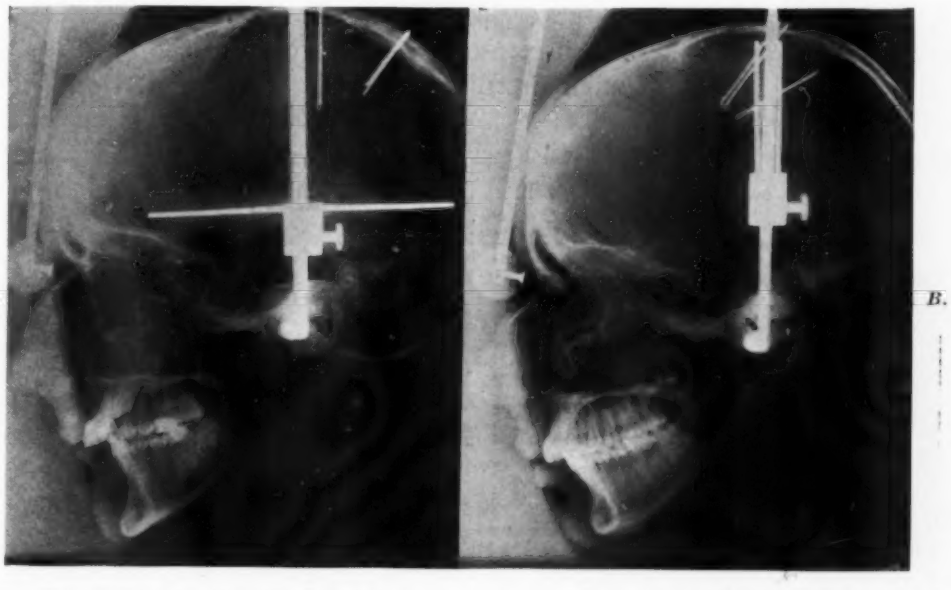

Fig. 5.—The patient in the roentgenogram, *A*, has a more pronounced dental deformity but less deformity of the lower third of the face than the patient in *B*.

In contrast, however, analysis of these roentgenograms which produce both soft and hard tissues reveals that, although the patient in Fig. 5*A* has the most dental deformity, the bony chin point is well developed, the musculature and integument over it are comparatively thin, and there is no roll in the muscles and integument of the lower lip. In Fig. 5*B* the bony chin point is of more usual development, the muscle and integument over it are comparatively thick, and the lower lip exhibits a deep roll.

If facial contours are improved during the treatment of cases, it should be of practical interest to see whether one significant contributing factor is the change in the relation and amount of soft and hard structures.

INTERPRETATION OF THE PROFILE ROENTGENOGRAM

After it is possible to produce satisfactory profile roentgenograms, the factor of next importance is to be able to read or interpret them correctly. A thorough knowledge of the hard and soft tissue anatomy of the head is a prerequisite to ease of interpretation, but of equal importance is the knowledge of how the shadows of these structures appear in the roentgenogram and the ability to differentiate between those of the left and those of the right side.

As an aid in such differentiation it has been found convenient to have at hand for constant reference the profile roentgenograms of an almost perfect skull which has been wired to bring out some important landmarks (Figs. 6 and 7). (The mandible of this skull has retained its correct relationship to the cranium through a mummification of certain muscles and ligaments and the capsule of the joint.) The parts wired are all on the left side, or that next to the film, with the exception of the orbital wires in Fig. 7 in which case both orbits are outlined, the solid wire being on the left orbit. The parts wired include in Fig. 6 the outline of the bony orbit to the lowest point (orbital point), the lower and posterior borders of the mandible, the tip of the mastoid, the condyle of the occipital bone, the mesial and distal of the maxillary first molar, the prominence of the buccal cusp of the tooth, and the buccal groove of the mandibular first molar. In Fig. 7, wires outline both the left (solid) and the right orbits with vertical wires at the orbital points, the zygomatic arch, the temporal and zygomatic border of the zygomatic bone, the root of the zygoma or key ridge, and the prominence of the mesiobuccal cusp of the maxillary left first permanent molar.

Fig. 6.

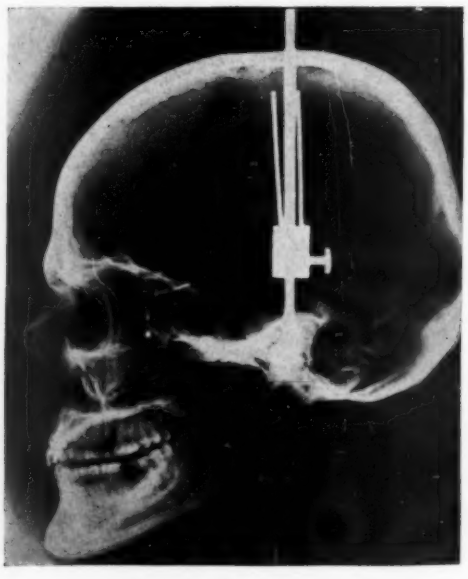

Fig. 7.

Figs. 6 and 7.—Profile roentgenograms of a skull with parts outlined with wire to indicate important structures and landmarks.

Since the structures of the right side of the head are further from the film than those of the left side, their shadows will not superimpose in the roentgenogram. In the technique used herein the midcentral ray passes

through the center of the ear rods. Therefore, if the parts of the facial skull nearest the film are below this level their shadows will hold an upward and backward relationship to those of the opposite side (as the teeth, mandible, and root of zygoma or key ridge) if on the level, a backward relation (as the orbital point); and if above this level, a downward and backward relation (as the bony orbit). Note that the wire outlining the mandible shows the lower

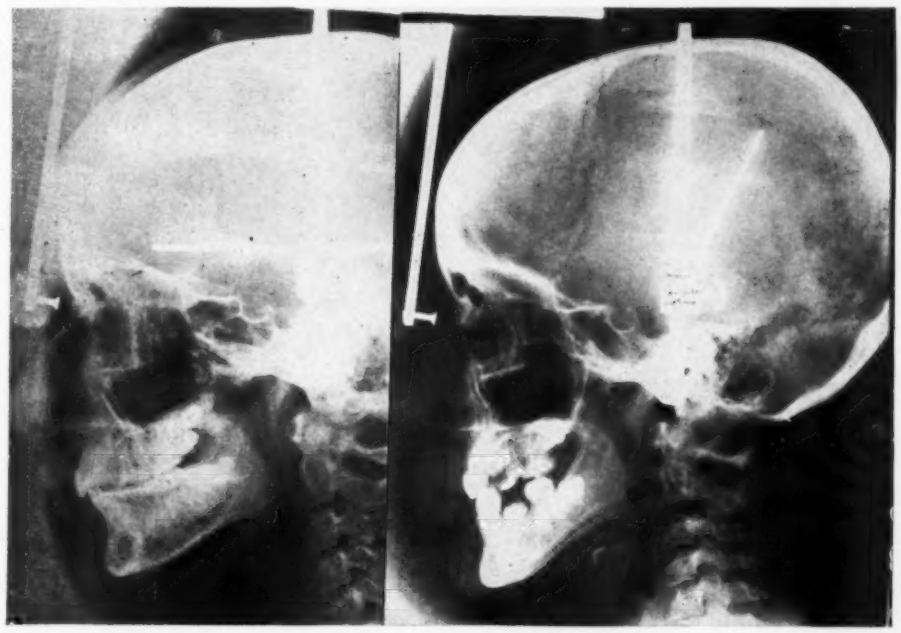

Fig. 8.—Two cases of Angle Class I malocclusion. *A*, Shows the usual adult gonial angle of about 120 degrees and the posterior wall of the nasopharynx free of enlarged adenoid growth. *B*, shows the infantile gonial angle of about 140 degrees and enlarged adenoid growth extending into the nasopharynx from the posterior wall.

Fig. 9.—Congenital absence of all permanent teeth with the exception of the four first molars in a boy of 9 years. Note the good jaw development.

border of the side nearest the film to be above that of the opposite side, but the lower borders cross close to the gonial angle so that the posterior border of the ramus of the near side is the more posterior of the two.

THINGS SEEN IN THE ROENTGENOGRAMS WHICH ARE USUALLY NOT REVEALED OTHERWISE

1. Especially in mixed dentitions the state of development of permanent teeth, the amount of resorption of deciduous roots and the relation of all teeth to the supporting structures (Fig. 10*B*).

2. Congenital absence of teeth (Fig. 9).

3. Internal and external cranial development including the sinuses and pituitary fossa (all profile roentgenograms herein included).

4. The gonial or mandibular angle. Note the pronounced difference in Fig. 8*A* and *B* of Class I cases and in Fig. 10*A* and *B* of Class II cases. Should this be considered in planning treatment and will any change in this angle result from treatment?

5. Excessive adenoid growth as evidenced by the light area extending into the nasopharynx from the posterosuperior surface (Figs. 2*B*, 5*A*, 8*B*, 10*B*).

6. Relationships between the hard and soft tissues.

Since knowledge of the above is a distinct aid to diagnosis and in most cases it is obtainable only in this manner, the value of such roentgenograms seems apparent.

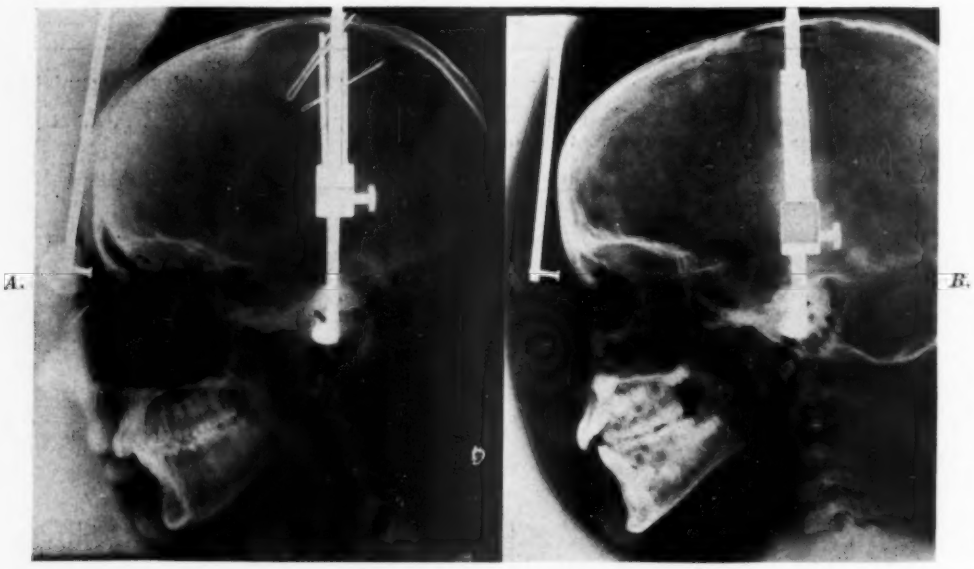

Fig. 10.—Two cases of Angle Class II malocclusion. *A*, shows the usual adult gonial angle of about 120 degrees and the nasopharynx free of enlarged adenoid growth. *B*, shows an infantile gonial angle of about 140 degrees and enlarged adenoid growth extending into the nasopharynx from the superior and posterior walls.

COMPARISON OF ROENTGENOGRAMS TO DETERMINE CHANGES INCIDENT TO TREATMENT

While it is possible to discern changes that have occurred during treatment or after retention by visual comparison of any two rentgenograms from a

series of the same patient, it is not satisfactory. For example, in Fig. 11 if *A* and *B* are compared, it is obvious that the overjet and overbite of the incisor teeth have changed but just what tooth movement or alterations in the supporting structures have occurred to bring this about would not be easily determined by observation alone. However, by correctly superimposing the roentgenograms such determinations are made possible.

Since it is advantageous to superimpose tracings rather than the roentgenograms this is the method chosen. The tracing is done on Ridgid Kodapak (suggested by McDowell[4]), a high grade cellophane which is transparent and waterproof, does not change shape, and takes India ink readily. Any number of tracings may be superimposed and read with ease (Fig. 14).

In order to superimpose correctly the tracings of the roentgenograms taken at intervals and thus determine the changes resulting from treatment, it is necessary to choose some method of orientation that will permit selection of points removed from the area of change and will, at the same time, take into account natural growth changes.

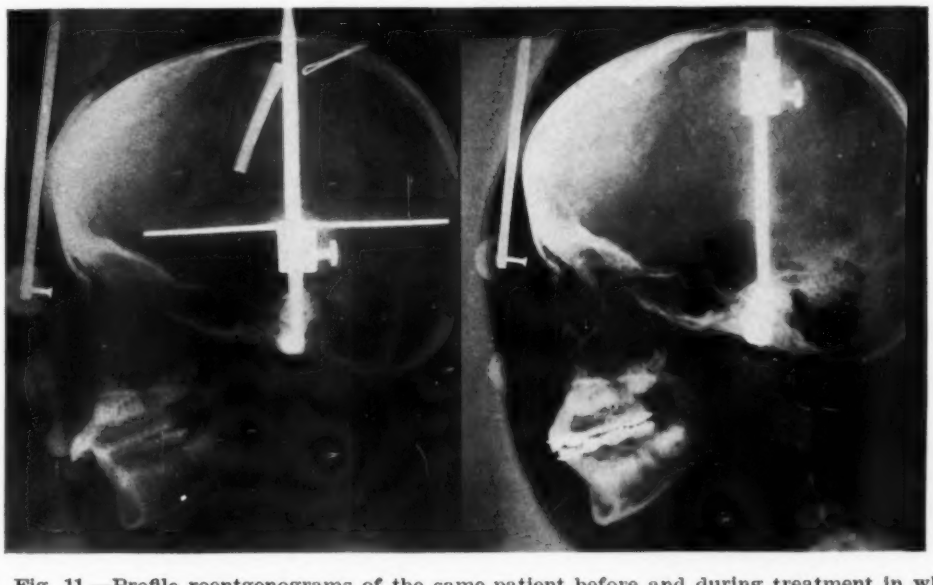

Fig. 11.—Profile roentgenograms of the same patient before and during treatment in which the changes in the overbite and overjet are easily observed. Observation alone, however, is not satisfactory since it does not prove what has occurred to accomplish this change.

In this technique the registration point and cranial base line (Bolton-Nasion Plane) used by Broadbent[1] are selected for such superimposition of tracings (Fig. 12). While considerable change may occur in the facial structures through normal growth or as a result of orthodontic treatment, little or no change occurs in the cranium during the age when most orthodontic cases are treated (nine to fourteen) because its growth is almost complete by that time (Fig. 13). Therefore, the cranial structures will often exactly superimpose, in which case no method of orientation is needed. When this is true, the changes in the facial area cannot be doubted. It must be remembered also that considerable change may occur in the dental area in a very few months under orthodontic treatment while the cranium shows no measurable change during this interval.

ANALYSIS OF THE CHANGES PRODUCED BY TREATMENT

A single case will be used to demonstrate the use of the roentgenogram tracings in analyzing the changes occurring as the result of orthodontic treatment.

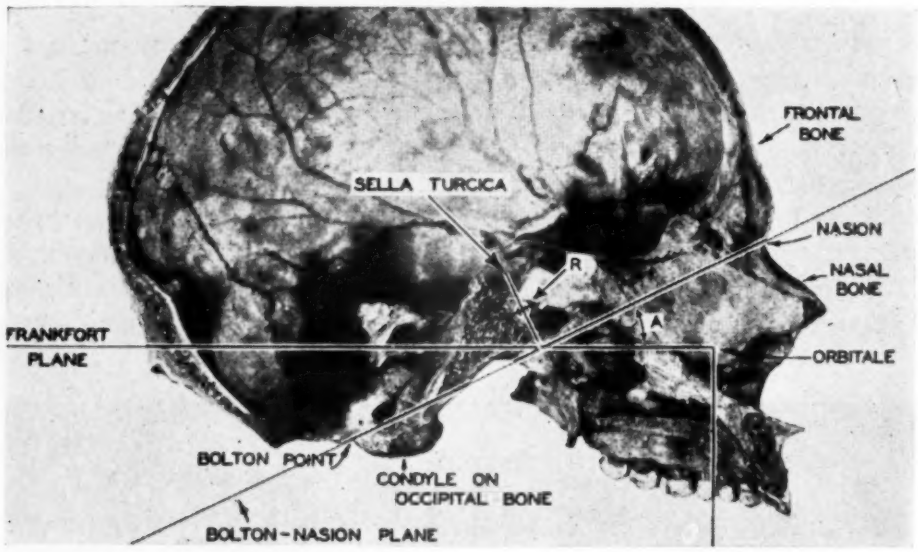

Fig. 12.—Median sagittal section of skull showing anatomic and craniometric landmarks and the Bolton point and Bolton plane. *R* is the registration point (Todd).

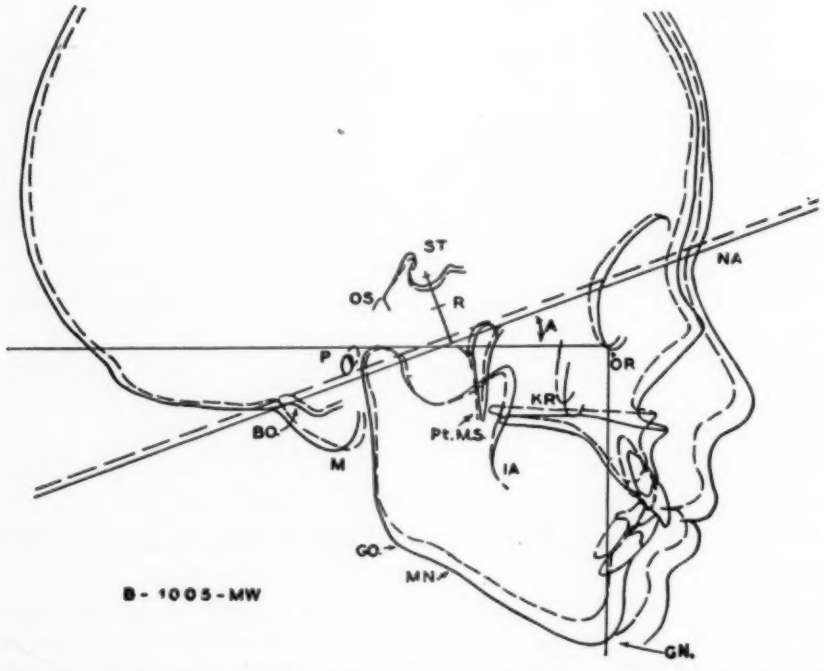

Fig. 13.—Tracings of nine and fourteen and one-half developmental years. Note relative stability of Bolton plane during the range when most orthodontic cases are treated (Broadbent).

A boy, 14 years of age, had always had a dual bite. Since there was no tooth interference, the mandible could be positioned to give a correct mesio-

distal relation of the posterior teeth or a complete cusp discrepancy of the Angle Class II type. The usual position of the mandible was in the posterior relationship.

The superimposed tracings in Fig. 14*A* show the relation of the mandible to the maxilla when the patient was biting forward with the posterior teeth in correct interdigitation, and when biting back with the lower posterior teeth a full cusp distal to correct interdigitation. After two months of treatment the patient had the correct mesiodistal relation of the maxillary and mandibular teeth and could apparently no longer bite back into a distal malocclusion. This was interpreted to mean that the mandible had assumed and maintained its forward position. Not until the tracing of the roentgenogram taken at this time (Fig. 14*B*) was superimposed over the one taken two months earlier, when the patient was biting with the mandible retruded, was it suspected that in so short a time all the maxillary teeth, both erupted and unerupted, had been carried distally the width of a cusp, and that the mandible was in the same retruded position as when the patient had bitten back as far as possible. For a more complete analysis of cases by this method refer to articles by Brodie,[5] and Higley and Speidel.[6]

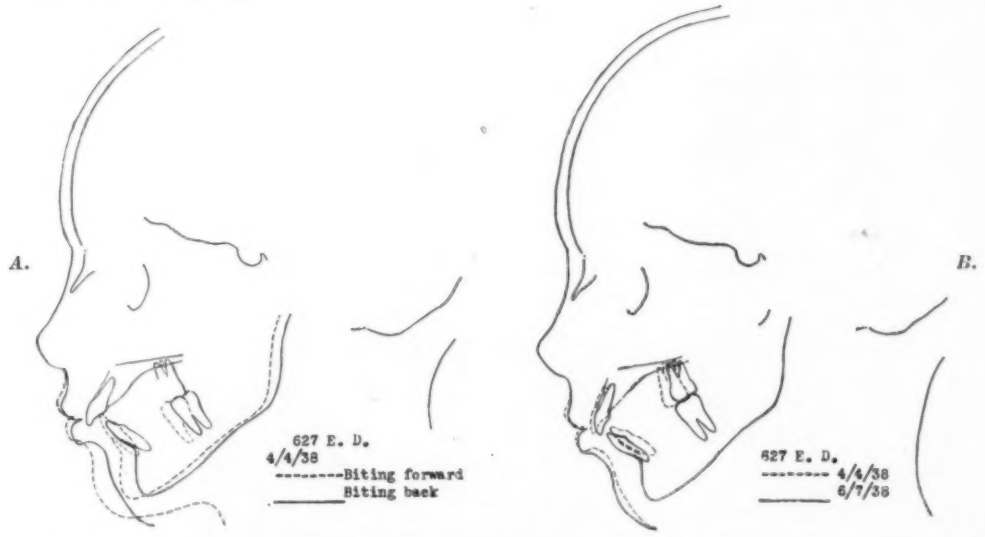

Fig. 14.—Superimposed tracings of a case of dual bite. *A*, Broken line shows patient biting forward and solid line biting back. *B*, broken line is the same as solid line in *A* when mandible is retruded. Solid line is superimposed tracing of roentgenogram taken after two months' treatment. Note the distal movement of the maxillary molar and that the mandibles superimpose exactly.

SUMMARY

Correctly oriented roentgenograms should greatly enhance the ease and accuracy of diagnosis since they make it possible to determine the relationships of the teeth to the jaws and of both of these structures to the cranium as well as that of the soft and hard tissues to each other. Furthermore, more detailed determination of changes resulting from treatment are made possible by superimposition of a series of such roentgenograms.

And finally, as a result of such determinations, causes of relapse may be discovered or better understood and empiricism eliminated since improved methods of treatment may be evolved and instituted.

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TREATMENT REQUIRING TIPPING AND BODILY MOVEMENT OF TEETH

RICHARD A. SMITH, D.D.S., EVANSTON, ILL.

THIS is a report of two cases in which the McCoy open tube was used as an aid in bringing about the desired tooth movement. The first case is one in which a tipping movement of the maxillary incisors was necessary in the course of treatment. The second case is one in which root movement was necessary to bring about a correct axial alignment of the maxillary incisor teeth.

CASE 1

History and Attributed Etiology.—In February, 1932, a girl, 13 years of age, presented for the treatment of a Class II Division 2 malocclusion (Angle). The adenoids and tonsils had been removed at 5 years of age. The patient was a normal breather. No habits were reported which might have had an effect upon the occlusion.

Fig. 1.

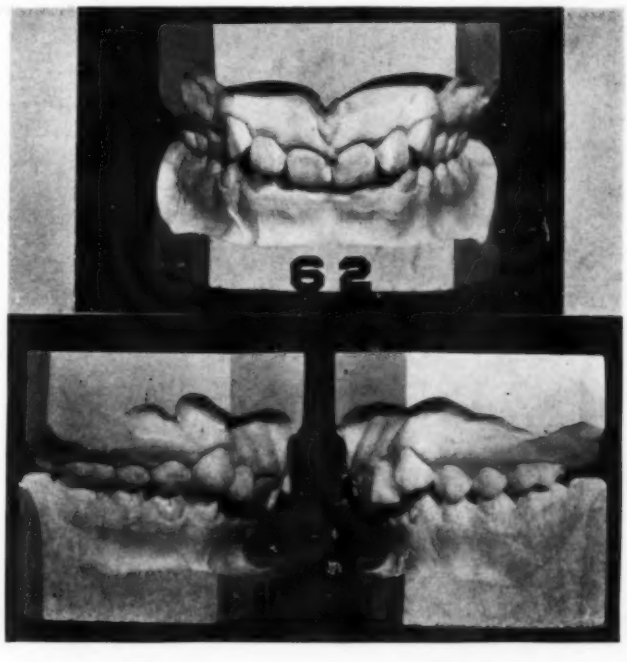

Fig. 2. Fig. 3.

Diagnosis.—This case was classified as a Class II Division 2 (Angle). The maxillary arch needed some widening and lengthening. The maxillary incisors needed to be depressed and tipped labially. The mandibular arch needed to be lengthened and the left canine rotated into position. The lower arch was too far distal and the upper posterior segments seemed to have drifted slightly mesially (Figs. 1, 2, 3, and 4).

Read before the meeting of the American Association of Orthodontists, Chicago, Ill., May 14, 1940.

Treatment.—All first permanent molars were banded. In the maxillary arch a plain labial appliance, .040 in diameter, with lingual extensions and intermaxillary hooks was placed. Loop springs .022 in diameter were used mesially to the buccal tubes. In the mandibular arch, a lingual appliance with intermaxillary hooks on the molar bands was placed. Intermaxillary force was used against the maxillary molar teeeth by opening the loop springs in front of the buccal tube, thus keeping the arch wire away from the anterior teeth. In this way, some distal movement of maxillary buccal segments was attained. When the molar relationship was correct, the maxillary incisor teeth were banded, and the McCoy open tube attachment was used. With this attachment, the central and lateral incisors were depressed some and tipped labially. In the mandibular arch a plain labial appliance, .040 in diameter, with .022 loop springs was substituted for the lingual appliance.

Fig. 4.

Fig. 5.

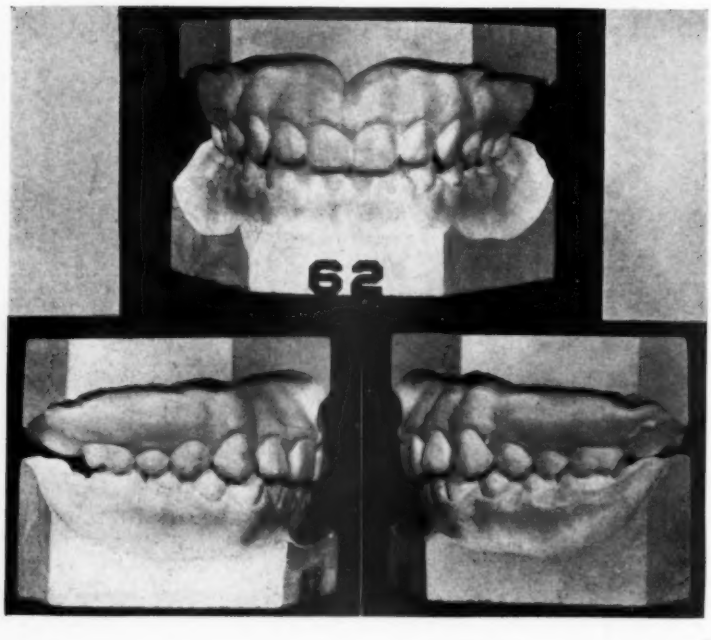

Fig. 6.

Fig. 7.

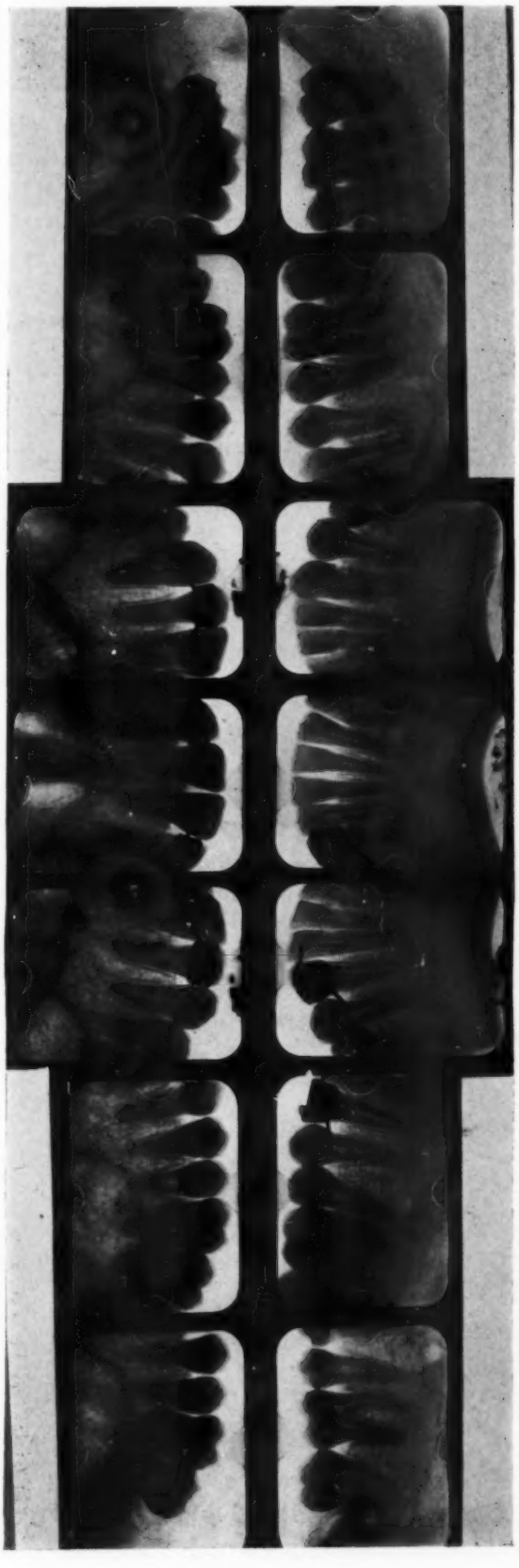

Fig. 8.

This appliance was used to lengthen the mandibular arch and to rotate the left canine into position, this tooth having been banded for rotation.

Results.—Figs. 5, 6, 7, and 8 show the results achieved.

Retention and Prognosis.—In March, 1934, the case was placed on retention. In the mandibular arch, a lingual appliance together with a band and spurs on the left canine to hold the rotation were used. In the maxillary arch, a lingual appliance was used. Bands with spurs were placed on the lateral incisors to hold them in position. In February, 1935, the lingual retainers were removed, but the anterior bands were left on until April, 1936. The patient has been in for observation on several occasions since their removal, and everything seems to be holding very well.

CASE 2

History.—This is a report of a girl, 11 years of age, who presented for the treatment of a Class I malocclusion in August, 1934. The adenoids and tonsils had been removed the year before treatment was instituted. The patient was a normal breather. The premature loss of the maxillary right second deciduous molar along with a general lack of development in the maxillary arch seemed to be the chief factors in causing the malocclusion present. No constitutional disorders were found which seemed to have any bearing on the malocclusion.

Fig. 9.

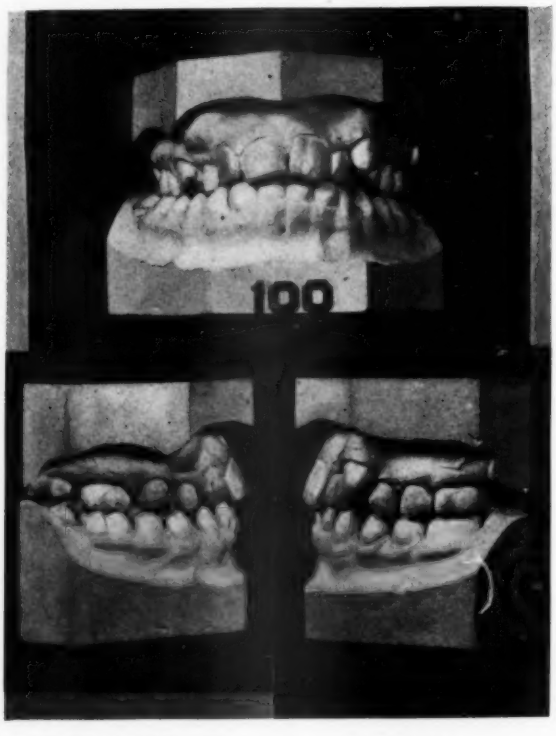

Fig. 10. Fig. 11.

Diagnosis.—This case was diagnosed as an Angle Class I malocclusion in which the maxillary arch was considerably underdeveloped. The maxillary right first permanent molar had rotated and drifted mesially to take up the

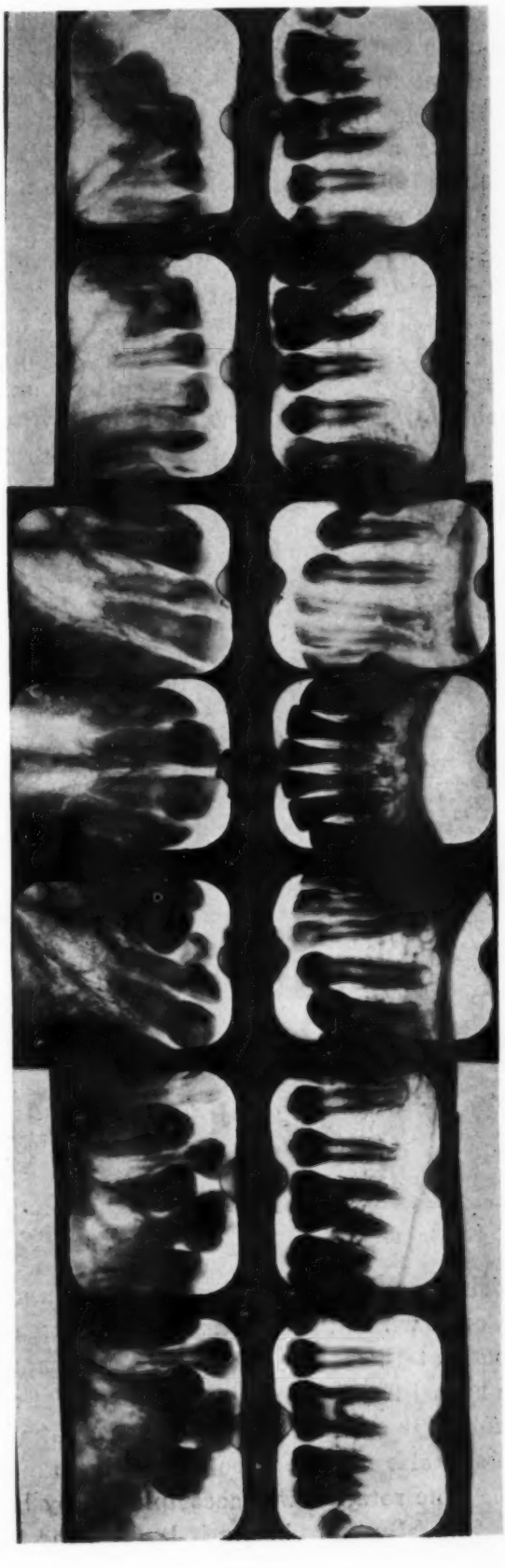

Fig. 12.

space for the second premolar tooth which was unerupted. The maxillary canine teeth did not have enough room in the arch, particularly the left one, which was almost entirely blocked out to the buccal. The maxillary incisor teeth were rotated with the mesial angle out. The axial alignment of these teeth was incorrect, the roots requiring a considerable amount of labial movement. The lack of room for the canine teeth was due almost entirely to this lack of development. The mandibular arch was well formed, and the alignment of all teeth was very satisfactory with the exception of the right canine tooth which needed to be rotated (Figs. 9, 10, 11, and 12).

Treatment.—In the maxillary arch, bands were placed on the first permanent molars with 18 gauge round buccal tubes and 18 gauge lingual extensions. Bands carrying McCoy open tubes were placed on the central and lateral incisors. A labial arch, with an anterior section of 22 gauge wire to engage the open tubes and an 18 gauge posterior section to fit into the buccal tubes, was placed. Coil springs of 0.010 stainless steel were used to control the length of the arch wire.

Fig. 13.

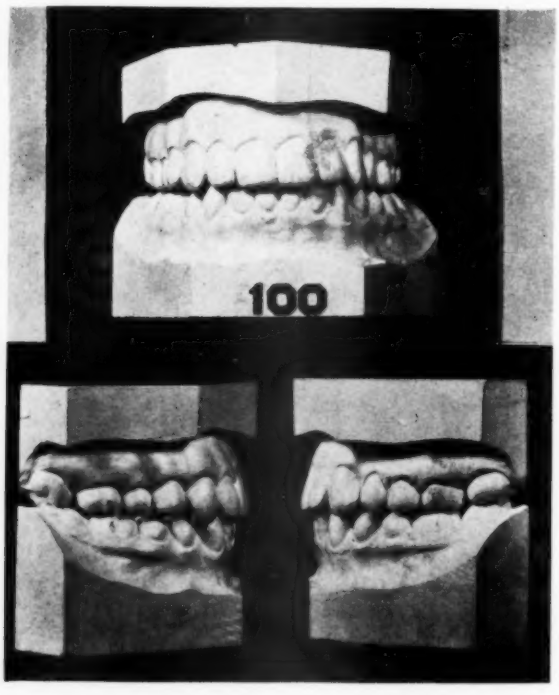

Fig. 14. Fig. 15.

Intermaxillary hooks were placed in the canine region and vertical spurs were soldered to the arch wire in the incisor region extending incisally to touch each incisor tooth at the incisal one-third. A removable lingual appliance with 18 gauge buccal tubes for the later reception of a labial arch wire was placed in the mandibular arch. The first step in treatment was to rotate the maxillary right first molar and to move it distally to make room for the second premolar tooth. The rotation was accomplished by bending the distal end of the labial arch lingually and placing it back in the tube thus causing

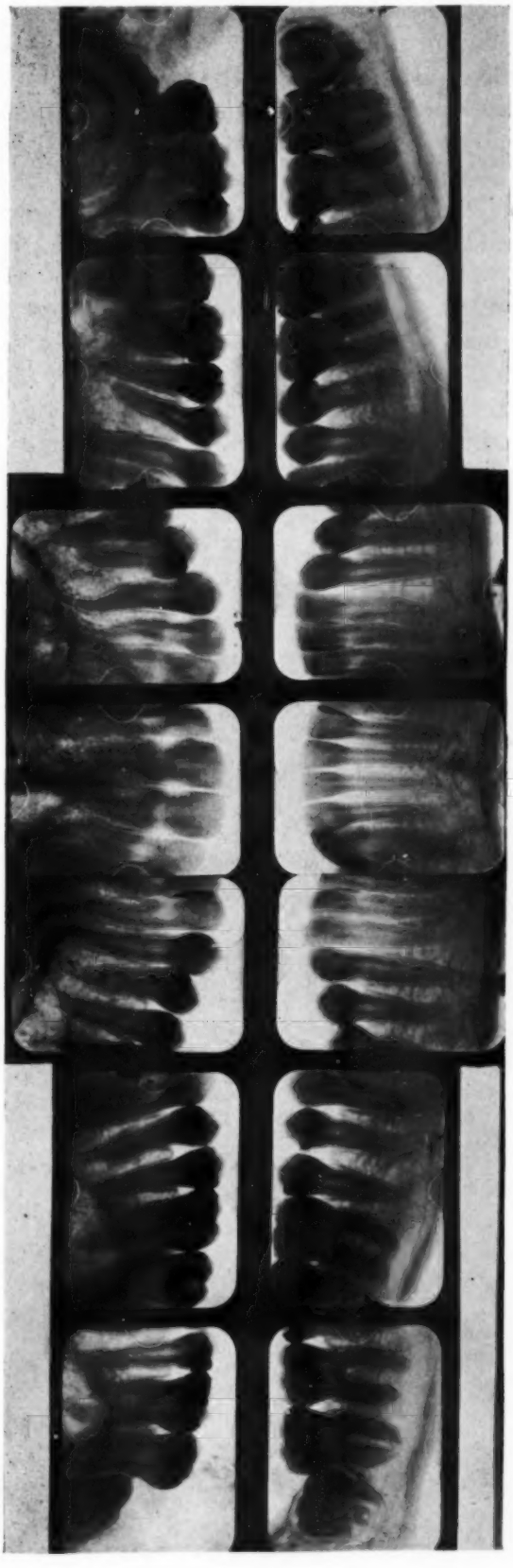

Fig. 16.

the mesial angle to rotate buccally. Distal pressure was applied to the molar tooth by opening the coiled spring and supporting the incisor teeth with intermaxillary elastics worn in a Class II manner. The vertical spurs were adjusted to place some pressure on the incisal one-third of the incisor teeth. The impacted second premolar tooth erupted very quickly when the space was opened for it and was moved into place with the lingual extension. Additional width was gained in the premolar region by the adjustment of the lingual extensions and the roots of the incisors tipped forward by the continued adjustment of the vertical spurs and coiled springs. The canine teeth were banded when sufficient room had been gained for them and were moved into place by the use of 23 gauge finger springs which were engaged in open tubes soldered to the bands. To accomplish the rotation of the mandibular right canine an 18 gauge labial arch wire was fitted and a band with a spur placed on the canine tooth. Silk ligature was used for ligating the tooth to the arch wire.

Results are shown in Figs. 13, 14, 15, and 16.

Retention and Prognosis.—In October, 1936, a Hawley retainer was placed in the maxillary arch and a canine-to-canine retainer in the lower arch. The Hawley retainer was worn day and night for a period of six months, then at night only for six months. It was discarded entirely at the end of that period. The mandibular retainer was discarded at the same time. The patient is being observed periodically, and the result attained is holding very well.

A THREE-DIMENSIONAL CONSIDERATION OF OCCLUSION*

HOWARD ELLIOT STRANGE, D.D.S., CHICAGO, ILL.

IT IS the purpose of the writer to merely review some of the facts regarding the study of occlusion in its relation to orthodontic problems. The views expressed in this treatise are a composite gleaned from the orthodontic literature and various ideas gained from the clinical experience of trial and error. Trial and error in the practice of orthodontics may, to a great extent, be eliminated by the beneficial influence of the cooperative efforts of the experienced clinician and research worker. Clinical findings must be submitted to the research specialist for analysis, and in turn the findings in the research laboratory must be put to a most severe test in clinical practice. Genuine understanding calls for an impersonal objective approach to problems, and an open mind. Research investigation and study bring about an elimination of conflicting thoughts. Successful treatment depends upon the operator's mastery of fundamentals and an application of these facts and laws in case analysis, diagnosis, and treatment. Claims which cannot be coordinated with the biologic facts of growth, development, and function, or which are not of universal application, are of little practical value, and, being such, cannot be fundamental.

A few paragraphs stating the writer's conception of normal occlusion of the teeth will serve as an introduction. The writer does not claim originality for any of the stated facts; they are fundamental laws applied as a guide to the procedure in treatment or observation. There is a proportionate variation in different individuals in nature's pattern, and fundamentally there are many factors which contribute to the balance of a tooth or teeth in function. The teeth are held in a balanced suspension by the fibers of the peridental membrane, and the changes in root forms and numbers (single and multiple) reflect the work that teeth individually are performing in function. There is a mutual relationship of each tooth to the others in the arch, and in turn a definite relationship of the teeth in one arch to the teeth in the opposing arch.

A conception of normal occlusion cannot be confined entirely to a harmonious relationship of the teeth, and a student of orthodontics must be well acquainted with the functions and anatomy of the related parts; namely the muscles, osseous structures, and parts directly related to the denture in function and growth and development. There is a reciprocal relationship of all these parts operating through the force of the inclined plane relationship of the teeth of the lower arch to the upper, and the dental arches have a definite and harmonious relationship to the normal architectural form and skull anatomy. Harmonious location and normal functional arrangement supply the demands for adequate functional efficiency of the masticating mechanism.

There must prevail a definite inclined positioning of the denture units, and each unit (lower and upper meeting in the line of occlusion) may be considered

*Submitted as a partial requirement for a certificate of The American Board of Orthodontics.

as an active component force. The meeting of these mesially inclined vectors of force results in an anterior component of force. This resultant action is an anterior propelling force existing to maintain normal, constant, and active proximal contacting of the teeth. This powerful forward propelling force associated with the inclined plane action acts as an aid in the forward and lateral growth of the denture. This force arises as a result of the normal mesioaxial inclination of the buccal teeth which causes them to meet one another, an upper with a lower, in a series of angles, the apices of which angles are directed forward so that the force resultant emanating from such a relationship is disseminated toward the front of the mouth. A strong group of muscles are arranged to resist or balance this force, and they blend and extend backward in an attachment to the basilar portion of the occipital bone.

There is a definite vertical positioning of the teeth anteroposteriorly and buccolingually, and the normal positioning of each dental unit in the arch resolves into a Curve of Spee. The position of the temporomandibular articulation, and the nature of the mandibular joint necessitate this curvature or apparent contact-occluding, spherical relationship. The curve provides ease of action and balance with muscular action in the various functional movements of the jaws and teeth in mastication.

Man's occlusion is a pattern that has evolved from simple forms; and the pattern of occlusion, through the gradual process of evolution, has gradually become more complex. There is a definite relationship of organisms to environment, and differences of environment change the demands for maintaining existence. That primarily accounts for the gradual change from simple cones in primitive forms to the more complex though ideal masticating mechanism that exists in the human today. The teeth are held and placed by a group of factors, some static and some dynamic, and only so long as these forces stay in balance will the teeth stay in normal occlusion. As soon as there is an upset or disturbance in one of the elements that maintain normal occlusion there is a resulting deviation from a normal, well-balanced mechanism.

One of the most perplexing problems in orthodontic practice is the correction of a deep overbite. If an apparent correction has been established by orthodontic treatment another very vexing problem is the retention of the corrected occlusal relationship and vertical dimension. Strang[1] states, "A careful analysis of cases that have presented an excessive overbite has led me to believe the following conclusions in reference to the denture areas at fault in this condition:

> *First:*—Excessive vertical overlapping of the anterior teeth may be due to supraocclusion of the incisor teeth. For some reason or another the maxillary and mandibular incisors (or perhaps the incisors in both dentures) erupt to a plane that is occlusally located to that which is in harmony with the line of occlusion.
>
> *Second:*—Excessive overbite may be due to an infraocclusion of the teeth in the buccal section of the denture, either in one arch or both.
>
> *Third:*—Abnormal vertical overlapping of the incisors may result from a combination of supraocclusion of the incisors and infraocclusion of the molar and premolar teeth.
>
> *Fourth:*—Rarely, it is produced by a complete lingual occlusion of the molar and premolar teeth of the maxillary denture."

Dr. Strang's four points of analysis have been generally accepted, and the writer has found that his method is the best approach to an analysis of the problem.

A careful observation and study of the patient, casts, roentgenographs, and photographs will aid in locating the various areas at fault in overbite cases. Cephalometric roentgenographs taken serially of a group of patients undergoing orthodontic treatment will in future years help us to more definitely proceed in treatment. A series of cephalometric roentgenographs of a control group of normal growing children from birth to adolescence with particular reference to vertical development in the area of the alveolar process will more adequately portray when the greatest amount of vertical development occurs. Broadbent[2] has indicated, "Alterations in anatomic form and structure of the facial parts are affected by ill health most in the development of the facial mass downward and forward, less in the lateral dimension, and least in the vertical dimension. Ample evidence indicates that in the mandible the two principal developmental centers are at the junction of the body with the rami along the line between the internal angle and mandibular notch. The Bolton findings indicate that this site usually has less effect, except in Class III malocclusion, on the relation of the lower face to the rest of the head than the sites at the posterior end of the maxilla in the region of the pterygomaxillary suture and the developmental center above the maxilla."

Clinical observation and careful analysis would seem to indicate that occlusion is not so readily changed, and does not remain permanently altered by employing bite planes and guide planes in orthodontic treatment. Deep overbite problems seem to be mainly concerned with a lack of proper development in the alveolar process coincident with improper orientation of the teeth particularly in the buccal segments. This can be amplified by Broadbent's[3] statement that, "The real value and import of the axial inclination of the teeth in relation to their immediate supporting structures and to the facial mass as a whole will become more apparent as one realizes their significance as diagnostic signs of abnormalities in the development of the face." It has been stated by Hopkins[4] that, "The occlusion is changed from a posterior relation of the mandibular teeth to a more normal anteroposterior relationship. This occurs as the premolars and molars settle down into occlusion." Such an observation would seem to be based on a two-dimensional analysis of the problem. If the vertical orientation of the teeth is not considered we cannot expect a permanent result after the employment of such a method of treatment.

In Class II conditions there exists a definite distal thrust on the mandible, and in Class III conditions there is a definite forward thrust on the mandible. These abnormal thrust forces are brought about by the improper orientation of the vertical inclination of the buccal teeth in the dental arches. The use of the bite plane appliance does not change the biomechanical factors associated with the evolvement or production of Class II malocclusions. Bringing the mandible into a Class I relationship only changes cusp interdigitation and does not change vertical alignment of the teeth. The important normal forward resultant of force felt through the inclined plane action of the teeth does not exist, and the balance of normal vertical components is upset. The buccal teeth are inclined in abnormal axial inclination, and because of this backward abnor-

mal thrust force there is a retardation in the forward development of the mandible. The mandibular molars are in a posterior relationship to the maxillary molars, and the weight of occlusal stress pounds the anterior section and mesial marginal ridge of the mandibular molars. The mandibular molars are inclined in an excessive mesioaxial position, and in a position of infraclusion. In mixed dentures the mandibular first permanent molar is in excessive mesioaxial inclination. The lower arch is short because of the lingual tipping of the mandibular incisors and canines, and the abnormal forward inclination of the mandibular molars. The premolars are in infraclusion because of the inadequate space between the mandibular canines and first molars. They cannot erupt to a proper vertical position, and an exaggerated curvature of occlusion is present. If no attention is given to a consideration of the third dimension (the proper axial inclination of the teeth) the backward thrust force will continue to operate no matter whether depression or elevation of the teeth has occurred. If depression of the mandibular incisors does occur and the buccal teeth are elevated without any attention to the third dimensional factor in occlusion, the distal thrust force will not in any way be eliminated by bite planes and guide planes. The teeth must be oriented so that there is a definite inclined positioning of the denture units into a reciprocal relationship of all parts operating through the force of normal inclined plane relationship. Proper inclined plane relationship cannot be maintained without orthodontic movement of the teeth into a proper axial positioning that produces a normal force resultant in a forward direction. An apparent normal cuspal lacking of the teeth is not enough to insure a permanent result.

The writer uses bite planes in the treatment of Class II Division 2 cases only to eliminate interference with the mechanical action of appliances used in treatment. Often it is difficult to place bands on the mandibular anterior teeth because of the deep overbite. The bite plane is used in conjunction with the other orthodontic therapy until such time as interference is eliminated.

Hopkins[5] states, "It [the bite plane] causes the condyles of the mandible to move forward on the eminentia articularis. As adaptation of the tissues takes place the condyles slide back to their ordinary relation." Rogers[6] is of the same opinion, but the fact that this occurs does not indicate that adaptation of tissues will occur. In Class II cases the distal thrust on the mandible exists because of the abnormal axial inclination of the first permanent molars in mixed dentures and all the buccal teeth in permanent dentures. Moving the condyle forward will not change the vertical relationship of the teeth, and after a long period of retention the mandible will gradually slip back to a distal position. We cannot be definitely sure that the condyle changes occur, or even that changes in the form of the glenoid fossa can be influenced until we have roentgenographic evidence accumulated from thousands of cases. Brodie[7] has indicated that, "The maxilla and mandible increase in height mainly by additions to the alveolar border. The need for an area of growth adjustment should be immediately apparent. A mechanism is needed to keep the lower jaw retreating from the maxilla. This mechanism lies in the condyle, which apparently grows from an epiphysis like a long bone. This leads to a marked lengthening of the ramus and maintains a relatively constant plane of occlusion." The adjust-

ment at the neck of the condyle is purely a growth adjustment, and we cannot definitely say that function will change the condylar relationship or adaptation in the glenoid fossa. Indicating that the condyles slide back to their ordinary relation is still conjecture, and there is still some doubt that a change in the articulation of the teeth alone will be accompanied or followed by the desired and hoped-for changes in the other features of the developmental growth of the face. Function does not seem to change form as quickly and as easily as has been indicated by many writers in the past. If a change does occur we are not prepared to state whether it is the result of growth or function, or a combination of both. We seem to see much more than actually happens, and the writer is inclined to agree with Reisner's[8] statement, "It is a fallacy to expect a new glenoid fossa to form to accommodate a condyle head that has been forced forward through traction of a bite plane and maintained there. . . . The only reaction I find is a destructive action of the posterior surface of the articular eminence or the anterior margin of the condylar head, or a combination of both." The statement of the course of growth given to us by Hellman[9] is a valuable and useful guide with particular reference to the problem of vertical development. Hellman states, "The highest percentage of anteroposterior growth occurs between the completion of the deciduous dentition at three years and commencement of eruption of the first permanent molars at six. There is, however, vigorous growth until the ninth year, very little between nine and eleven years, but some in adolescence, to accommodate the second, and particularly, the third permanent molars. Vertical growth, slow until the ninth year, is vigorous from nine years until puberty in girls, and to the close of the second decade in boys. Transverse growth is slow until the sixth year. It then increases, though much less rapidly than the other dimensions, until puberty or thereabouts. The greatest percentage of growth in both vertical and transverse directions occurs between the eruption of the first and second permanent molars." If there is a definite correlation between success in treatment and growth it would seem that we would be able to accomplish the most beneficial results between the ages of seven and ten. Orthodontics, like all young sciences, is still somewhat unsure of its objectives because of a lack of supporting and substantial evidence. We have not accumulated enough evidence to be definitely sure how much the changes induced by tooth movement affect growth and proportional development. Cephalometric roentgenographic evidence accumulated over a long period of time will eventually indicate whether or not the changes brought about by tooth movement mainly are restricted to the alveolar process.

A cursory or casual examination of the presenting abnormal conditions is not enough to determine the etiology or causes of improper growth and development. An orthodontist is concerned with dentofacial deformities which in character are complex morphologic deviations. The scientific analysis or evaluation of the nature, effect, and extent of an abnormality is not a simple procedure, and we are concerned with a problem of great complexity. The analysis of any malocclusion requires a three-dimensional analysis, and an observation with particular reference to the third dimension, axial inclination of the teeth. One should always be mindful of practical considerations especially those peculiar to the individual case. This applies in all our work where the intelligence and

ingenuity in application of the operator should come into play in individual case analysis. A differential analysis of each problem is governed by certain established and sound principles, and after making a complete analysis of each problem we cannot blindly treat all cases in the groove of a fixed theoretical concept. Cases may be cited as examples, and instances can be brought to our attention to apparently prove practically any theory, but when it comes to the practical application we are often confronted with a far different picture. We must be able to apply a broad application of principles substantiated by a biomechanical philosophy that has received the test in clinical application.

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2376 E. SEVENTY-FIRST STREET

Department of Oral Surgery and Pathology

Edited by

STERLING V. MEAD AND KURT H. THOMA

Articles on oral surgery, radiography, and anesthesia should be submitted to Dr. Sterling V. Mead, 1149 Sixteenth Street Northwest, Washington, D. C. Articles on oral pathology should be submitted to Dr. Kurt H. Thoma, 53 Bay State Road, Boston, Mass.

MANDIBULAR RESECTION

ARTHUR S. HAYNEN, D.D.S., NEW YORK, N. Y.

THE technique of mandibular resection has differed from time to time, and each year produces new and simpler methods. Many of the previous techniques have been discarded by the oral surgeon, and it is the purpose of this paper to discuss one of the later procedures followed when such an operation is indicated. A definite advantage of this operation is that it is not necessary, nor is it indicated, to remove any portion of the mandible, whereas in previous methods, rather mutilating surgery was often resorted to, in order to obtain an esthetic and functional result which was sometimes rather questionable.

Mandibular resection is indicated in certain cases of Class III malocclusions, which are so severe that the oral surgeon can give great aid to the orthodontist in helping to achieve a satisfactory result. The purpose of the operative procedure is to create an artificial fracture in both rami, and to reposition the anterior mandibular fragment, so as to be in harmony with the maxilla.

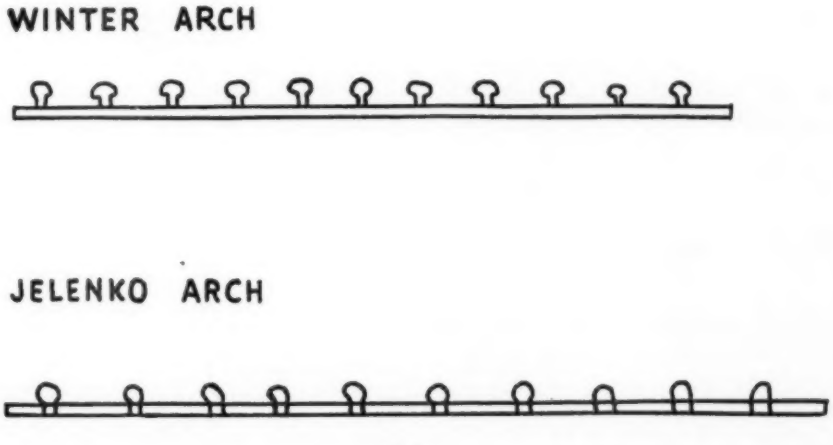

Fig. 1.

The first step in the operation may be accomplished in the dental office. This requires the placing of labial arch wires on both the maxillary and mandibular teeth. The arch bars may be either of the Winter arch type or of the Jelenko variety (Fig. 1).

The arches are adjusted to conform to the labial and buccal surfaces of the teeth, and then wired in place with Angle's 24 gauge brass ligature wire. The cut ends of the brass wire are turned inward so as not to irritate the mucous membrane of the lips, cheeks, and tongue. The patient is then hospitalized for the remaining operative procedures. Either gas-oxygen-ether, or cyclopropane seems to be the anesthetic of choice. After the patient has been properly anesthetized, the skin surface of the mandibular angle region is carefully prepared by means of iodine swabs followed by alcohol. With a scalpel, the surgeon makes a small incision just posterior to the posterior border of the ascending ramus slightly below and anterior to the lobe of the ear (Fig. 2).

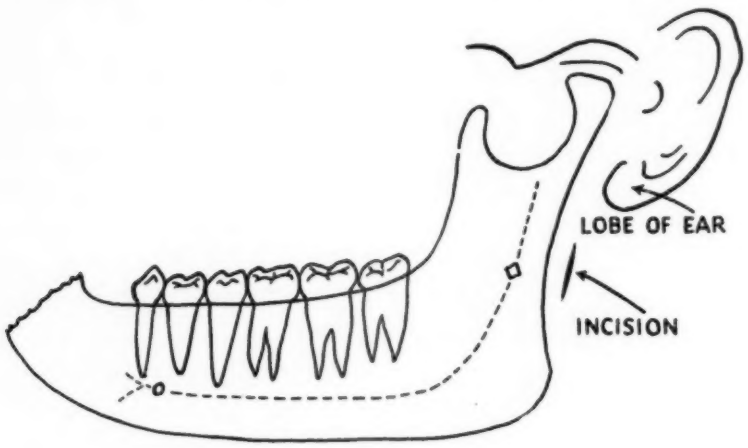

Fig. 2.

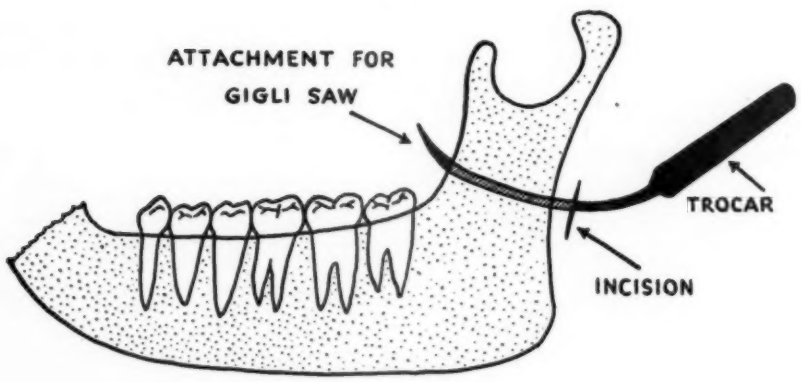

Fig. 3.

A curved antrum trocar is introduced in the incision and is made to glide beneath the internal surface of the ramus, and manipulated to come to the cheek just anterior to the external oblique line of the ascending ramus. This step must be made with great care for, if the trocar point is moved inwardly too far, the fibers of the internal pterygoid muscle will be pierced and destroyed during the resection. The trocar must hug the internal surface of the ramus and be in direct contact with the bone from the entrance point until its pointing is seen on the cheek at the anterior border of the ascending ramus. This eliminates injury to the inferior alveolar nerve and artery (Fig. 3).

The mucous membrane of the mouth is not pierced by the trocar. A small incision is made in the cheek and the point of the trocar is made to emerge at this point. A Gigli saw is wired in place on the trocar, and the trocar is withdrawn permitting the saw to follow through and emerge at the first incision. We now have the Gigli saw running from the anterior border of the ascending ramus and making an exit at the posterior border of the ramus. The wire connecting the trocar and saw is removed and handles are fastened in place on each end of the saw (Fig. 4).

While the assistant holds the head of the patient firmly, the surgeons saw completely through the ramus to the internal surface of the masseter muscle. This creates an artificial straight line fracture of the ascending ramus. The angle of the fracture line is shown in Fig. 5. The handles are taken off, and the saw is then removed by pulling it through the original incision. When the ramus has been completely resected, there will be a rather profuse hemorrhage which must be stopped with hot saline gauze packs. These are placed one on top of the other and are held in place by manual pressure.

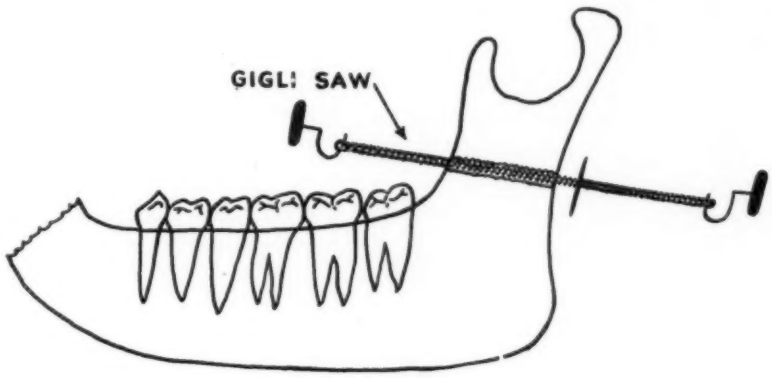

Fig. 4.

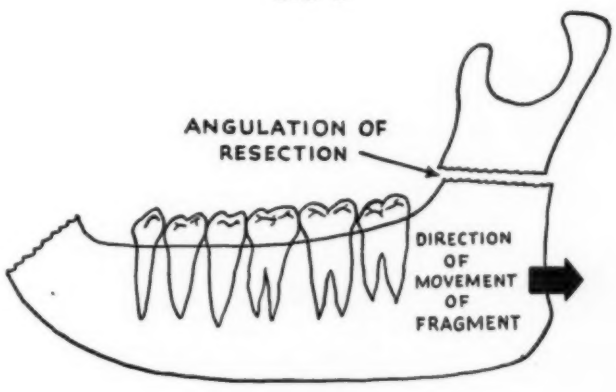

Fig. 5.

The patient's head is now turned to the opposite side and the same procedure is followed. The saline gauze packs are left in place; the weight of the patient's head serves to hold them with enough pressure to control the hemorrhage. The bleeding of the opposite side is arrested in the same manner. After cessation of hemorrhage, dermal sutures are placed in the four skin incisions, and a firm pressure bandage is placed around the head.

The pressure bandage serves to control hemorrhage and to give support to the mandible fixing it firmly against the maxilla.

The condition is now an artificially created fracture of both rami. In twenty-four to thirty-six hours the patient is seen again for the final stage of the operation. This consists of repositioning the mandible to its new retruded position, and the fixation by intermaxillary wires connected to the maxillary and mandibular arch bars. It may be necessary at first to place intermaxillary elastics composed of cut stethoscope tubing in order to draw back the anterior mandibular fragment by traction. When the desired position is reached, twenty-four gauge brass ligature wires are substituted for the elastics. About three connecting wires on each side and one in the anterior region will be sufficient. The mandible now assumes its new relationship to the maxilla, and from this point on the treatment is the same as for a bilateral noncomminuted fracture of the rami. The dermal sutures are removed about the fifth day, and the small skin incisions usually heal very well.

The patient is observed about twice a week, the wires being checked and the occlusion watched very closely. It is imperative to take x-rays of the fracture sites each week to see that the fragments are in apposition and are uniting properly. Frequent mouth washes are advised, and a liquid or soft diet is prescribed. There is little if any postoperative pain and if present, it can be controlled by proper medication, e.g., codeine, one grain, and aspirin, ten grains, every four hours as long as the pain persists.

When the wires are removed and function is restored, judicious grinding and polishing of the interfering cusps is done giving an excellent functional and esthetic result.

CONCLUSION

A simplified technique of mandibular resection has been presented, eliminating many of the previous disadvantages of a mutilating operation. The ease of manipulation, the loss of time to the patient being at a minimum, the rapid recovery and the esthetic and functional result are the advantages claimed for this operative technique.

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18 EAST FORTY-EIGHTH STREET

FACIAL FISTULAS OF DENTAL ORIGIN

With Report of Three Cases

Sidney Irving Kohn, D.D.S., West New York, N. J.

CHRONIC fistulas of the face with their accompanying intermittent drainage are not infrequent. Since these abnormal openings are frequently of dental origin, and because the teeth as etiologic factors are occasionally overlooked, the following cases are presented.

Case 1.—D. G., a male, aged 8 years, in May, 1936, developed a severe pain in the mandibular left first molar. Toothache drops were applied at home with relief. The pain recurred a month later, at which time swelling of the jaw was noted. The patient was taken to a dentist who prescribed hot extra-oral applications. The swelling persisted and increased in size. A week later the child was taken to a physician who recommended further use of the applications. Two weeks later the swelling ruptured spontaneously, draining a considerable quantity of pus.

On August 24, 1936, the patient presented at the Children's Hospital Dental Clinic. Under the body of the mandible, on the left side, there was a soft red inflammatory area about 2½ cm. in length and 1 cm. in width. The anterior extremity of the lesion was open and draining (Fig. 1*A*). There had been intermittent drainage since the original swelling opened in response to the hot applications.

Fig. 1*A*.

Clinical examination revealed a badly broken-down mandibular left first molar with pulp exposure. Other carious teeth were present. Oral hygiene was poor.

Former Dental Resident to the Buffalo Children's Hospital, Buffalo, N. Y.

Radiographic examination of the area revealed rarefaction of the bone at the apices of both roots of the mandibular left first molar (Fig. 1*B*).

Under local anesthesia (mandibular block) the mandibular left first molar was extracted, and the granulation tissue was curetted from the fistulous tract. The margins of the external opening were freshened by light curettage, and a dressing was applied.

To date there has been no further drainage. The extraoral opening is closed, and the scar is considerably less prominent (Fig. 1*C*).

Fig. 1*B*.

Fig. 1*C*.

It is interesting in this case to note the general improvement in the patient in the short period of one month following the operation. For some time previous to operation the child was described as being listless and disagreeable. He neither ate well, slept well, nor cared to play. In one month following operation the child gained four pounds in weight. In the words of the mother, the child looked better, played better, ate better, slept better, and was much brighter.

Case 2.—H. P. was a male, aged 11 years. Approximately three years before presenting at the hospital the patient fractured the crown of the

mandibular left central incisor while playing with the clock-spring mechanism of a toy tractor. About a year following the accident a swelling of the chin was noted. The child was taken to the family physician who diagnosed the condition as "cellulitis." Hot magnesium sulfate packs to be applied twice daily were prescribed—using as much heat as the child would tolerate. The applications were continued for three days with subsidence of the swelling following intraoral drainage in the labiogingival fold opposite the fractured central incisor.

About three months prior to our examination of the child there was a recurrence of the swelling. Hot magnesium sulfate packs were again applied. This treatment was continued for three or four days. The swelling being quite painful, and, the treatment yielding no results, the child was taken to another physician who incised the swelling and inserted a drain. Closure of the wound followed removal of the drain. Two weeks later the wound reopened, and drainage ensued for a period of about three days. The parent described the discharge as being "watery" with a bit of blood in it.

On Feb. 20, 1937, the child was seen by a physician at the Children's Hospital. The case was then referred to us for consultation.

Clinical examination of the mouth revealed a fracture through the pulp of the mandibular left central incisor. Many carious teeth were present. Oral hygiene was poor. There was a crusting of the skin at the center of the mentum.

Radiographic examination revealed a rarefied area involving the apices of both central incisors. The process had spread from the left central incisor, which was the original source of infection.

Under local anesthesia both mandibular central incisors were removed. The granulation tissue was curetted from the fistulous tract. The crust was removed from the chin. The tooth sockets were dressed with iodoform gauze in which was incorporated a surgical paste.

To date there has been no drainage. Original fistulous opening is closed.

Case 3.—E. P. was a female aged 15 years. About two and a half years before the patient presented at the hospital she developed what appeared to be a pimple at the center of the chin. There was no acute swelling and no previous toothache.

In one week the pimple opened and a small quantity of pus was given off. Two months later the pimple recurred and opened again.

When the pimple recurred for the third time the patient was taken to a physician who cauterized the area. Closure was attained for a period of six months when the area opened again. The patient was then taken to another physician who also cauterized the area.

On May 5, 1936, the patient was seen by a physician at the Children's Hospital who described the lesion as a "small cone-shaped tumor extending from the cleft of the chin. Well epithelialized and vascularized. Impression: Pyogenic granuloma" (Fig. 2*A*).

The granulation tissue was removed by electro-desiccation. Two weeks later the area opened, and drainage was once again established. The patient was then referred to the Dental Department for consultation.

Clinical examination of the mouth revealed several carious teeth. Oral hygiene was poor. The mandibular right central incisor (noncarious) was malposed and was receiving an excess of the masticatory stress.

Radiographic examination revealed a well-defined area of rarefaction involving the apices of both mandibular central incisors.

Traumatic occlusion had probably started the cystic formation at the apex of the mandibular right central incisor. This had spread out to involve the mandibular left central incisor.

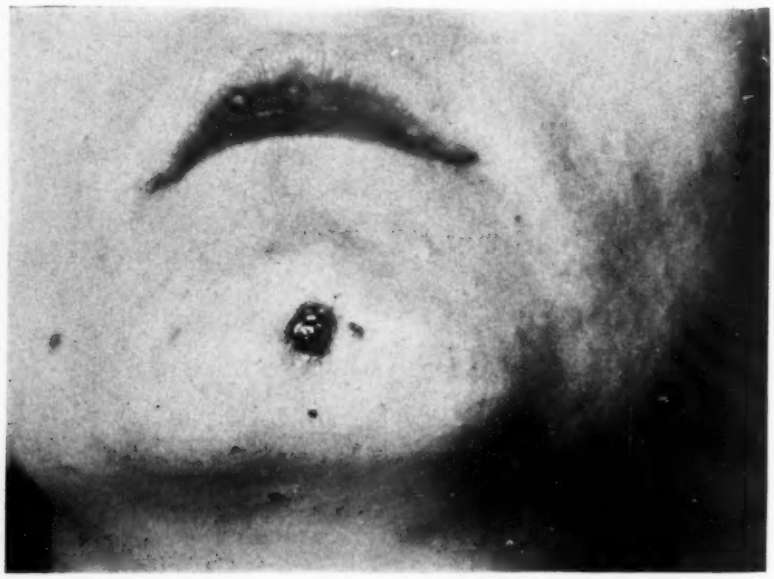

Fig. 2A.

Fig. 2B.

Under local anesthesia both mandibular central incisors were removed. The cystic membrane and fistulous tract were curetted out. The tooth sockets were dressed with iodoform gauze. The margin of the external opening was freshened, and a dressing was applied.

To date there has been no drainage. The external scar has almost entirely disappeared (Fig 2*B*).

DISCUSSION

It will be noted in all three cases that the patients sought the aid of their physicians, although one was first seen by a dentist. Only one of the three gave a history of toothache, in which case the tooth as the sourse of infection was given no attention once the swelling was reduced. In the remaining two cases the teeth as etiologic factors were overlooked.

Apical involvement of a tooth, in the form of an abscess or a cyst, usually results from carious exposure of the pulp (Case 1), fracture of the tooth crown through the pulp (Case 2), or from trauma, in the form of a blow or in the form of traumatic occlusion wherein one or more teeth receive an excess of the stress of mastication (Case 3).

Cases 1 and 2, after running a chronic course, became acute. The pus, after burrowing through the alveolar process of the mandible, found its way into the soft tissues, following the paths of least resistance and causing the involved soft tissues to swell to prodigious proportions. Such swellings, if injudiciously poulticed, may point anywhere on the face or along the lower border of the mandible. Spontaneous rupture of these swellings may leave disfiguring scars.

When these cases present early, it will be noted that the swollen area is at first firm. It is at this stage that abortion of the swelling may be accomplished by proper poulticing. Cold packs should be applied to the swollen area, in conjunction with the use of hot saline mouth washes. In this manner drainage, if any, may be accomplished intraorally, usually through the external alveolar plate. Poulticing of this type will usually eliminate the necessity of resorting to an extraoral incision.

In some cases an intraoral swelling at the mucobuccal fold is also noted. Here adequate intraoral drainage may be obtained by incising the swelling within the mouth and inserting a drain. Hot saline mouth washes are prescribed to facilitate further drainage.

Heat treatment in the form of hot wet dressings may be used in those cases wherein a softening of the inflammatory mass is noted when the patient presents. The packs, however, are applied only until the degree of fluctuance and pointing desirable for incision is attained. The patient must therefore be seen at regular intervals so that the hot packs will not be continued until spontaneous rupture takes place—being followed by its usual scar.

Extraoral incisions, if made below the inferior border of the jaw, will make scars less conspicuous. In swellings resulting from dental infections of the superior maxilla extraoral incisions are usually not necessary. The infection can usually be reached and adequate drainage obtained by an incision in the mucobuccal fold.

When the acute symptoms have subsided and the swelling is reduced, the patient should be referred to the dentist for the removal of the cause. If this is not done, the acute condition may recur or a facial fistula may be formed. Such fistulas are unsightly, are a source of chronic infection and constant irritation, and, with their intermittent drainage, do not add to the comfort of the patient.

Case 3 is illustrative of pulp death due to traumatic occlusion with subsequent cyst formation. Here also, medicodental cooperation is essential.

When cases of this type present themselves to the physician and no definite etiologic factor can be found, they should be referred to the dentist for clinical examination of the mouth and for radiographic examination of the teeth in the area involved.

Cauterization without the removal of the original focus is but a temporary measure. Closure may be brought about for a period of time only to be followed by a reopening of the fistulous tract. The longer the delay in removing the source of infection the greater the possibility of a spreading of the pathologic process to involve other teeth in the arch—not to mention the possibility of a pathologic fracture due to extensive bone destruction.

SUMMARY

1. Fistulas of the face are frequently of dental origin.
2. Such fistulas are frequently incorrectly diagnosed.
3. Such fistulas can be prevented by the proper treatment of the swellings that usually precede them, and by early removal of the cause.
4. When facial fistulas of dental origin are once established, removal of the cause is essential to their permanent closure.
5. Since removal of the cause is a dental problem, cooperation between the physician and the dentist is, therefore, desirable.

5922 Bergenline Avenue

LOCAL ANESTHESIA

IRVING SALMAN, D.D.S., NEW YORK, N. Y.

LOCAL anesthesia, as employed today, is far more satisfactory than when practiced even a decade ago. With the improvements in technique, solutions, and armamentarium the modern dentist has a powerful weapon in his combat against pain. Those signs in our windows years ago, *Painless Dentistry*—merely a phrase to lure patients into our offices—are no longer a myth, but a reality.

A satisfactory anesthetic must be painless, thorough, and devoid of any danger. The proper psychologic approach of the operator plays an important part in the successful use of local anesthetics. The operator should be quiet spoken, calm, and instill confidence. The apprehensive patient should be made to feel that he is absolutely safe and will feel no pain. The operator who is nervous, irritable, and who reprimands his patients for being nervous will make a difficult patient more difficult to handle. A local anesthetic eliminates pain but does not eliminate psychic impressions.

Before making the injection the operator should obtain the confidence of his patient; he should be tactful in his approach. Compare the operator who has had his necessary armamentarium prepared before his patient is seated in the chair and, after some reassuring words, proceeds with his injection with the operator who tells his patient, "This tooth must be extracted."

"But Doctor, last time I had a tooth out it hurt. The dentist jabbed several times and I still felt everything."

"I do it differently. I don't inject around the tooth. I use a big, long needle [flashing the needle in front of the patient] and inject way in the back of the mouth to block the main nerve. With this one injection half your jaw will be numb and part of your tongue as well." He then proceeds to prepare his armamentarium and, if the patient was not apprehensive originally, by this time he will be.

For the nervous patient, premedication is an important adjunct and will help the operator obtain the cooperation of the patient. The usual sedatives may be used or 3 gr. of sodium amytol, 10 gr. of bromural, or any of the barbiturates. An excellent premedicant which takes effect within fifteen or twenty minutes is three teaspoonfuls of Elixir Alurate (Roche). It has a pleasant, winey taste.

The operator must be observant and quick to notice any signs of reaction on the part of the patient. There are some patients who are liable to faint for the most trivial reasons. For the apprehensive patient the use of a topical anesthetic prior to the insertion of the needle is advisable, more for the psychic effect it may produce rather than positive results. The essayist has not found a topical anesthetic which gives complete anesthesia without destruction of the tissue.

Assistant professor of Oral Surgery at New York University College of Dentistry, New York, N. Y.; oral surgeon, Montefiore Hospital, New York; consulting dental surgeon, Harlem Hospital, New York.

Read before the Connecticut State Dental Association Annual Meeting, New London, Conn., June, 1940.

Tainter, Throndson, and Moose[1] and Tainter and Moose[7] reported in a blind test of seventeen different solutions on 457 patients. They obtained a high percentage of results by the use of inert solutions, such as normal saline, indicating that the claims made for topical anesthetics in the mouth must be regarded with skepticism.

Pain and infection are no more frequent following the use of local anesthesia than they are following the use of general anesthesia. Local anesthetics should not be blamed if we fail to adhere to the proper chain of asepsis. Prior to any injection a proper tray should be prepared. On the sterile towel, beside the sterile syringe and needle, there should be sterile gauze, applicators, and a thumb forcep. In fixing the surface bacteria before injecting, the tissues should be properly retracted. The surface should be wiped dry with sterile gauze and the bacteria fixed by the application of any of the accepted antiseptic solutions. Care should be instituted to prevent the tongue and soft tissues from collapse over the area that has been fixed and sterilized. In painting the tissue a wide field should be covered and not, as is often seen, a dot made where the operator intends the needle to enter the soft tissue. Often the aim is poor and the penetration of the needle is not through the surface where the bacteria have been fixed.

The operator should, at all times, have a clear vision of his field. The index finger, retracting the soft tissue, should not be removed until the completion of the injection and the withdrawal of the needle from the oral cavity. The operator must see that the needle does not bend, that the syringe and needle are in one axis. The needle used should be of sufficient length to permit at least ¼ inch of it to protrude from the soft tissue at the hub. Should the needle break, it usually breaks at the hub and, with the index finger still in position, it will prevent the soft tissues from engulfing the protruding end of the needle. With the distal end of the needle still protruding the operator can, with the aid of the thumb forcep which should at all times be on the tray, grasp the end of the needle and remove it without the patient being aware of the accident. If the needle breaks in the soft tissue, or if it is permitted to become engulfed into the soft tissue, the operator should not attempt to remove it unless he has the ability to do so. The patient should be referred to one who is qualified and who has had sufficient experience in the removal of broken needles. Failures in removing broken needles are due chiefly to an attempt to reach them through a small incision made at the point of injection. Failures are also due to attempts made by the specialist at the time when reaction to the trauma is still present, such as trismus, pain, and swelling. It is always best to wait until the same conditions exist as when the original injection was made, when the tissues are relaxed, when no trismus is present and when the patient can open the mouth to the fullest extent. The proper radiograms should be taken, lateral plate and anteroposterior plate. The lateral plate will show the approximate position of the needle on the ramus, while the anteroposterior plate will show whether the needle is buccally or lingually to the mandible. Breakage of needles is usually due to faulty technique, and it is not improbable to find them buccally to the mandible. The incision should be made at right angles and a few centimeters distal to the distal portion of the needle.

The ease with which anesthesia is obtained is the cause of many operators developing a careless attitude. They think they can shoot the anesthetic fluid in at almost any place and in almost any strength and dosage and obtain successful anesthesia. In those instances where anesthesia does not prove sufficient patients are generally blamed and told their pain is imaginary. Knowledge of the anatomy of the structures is essential in order that needless suffering may be avoided. Dr. Gaston Labat[2] who before his death was one of the foremost regional anesthetists and under whom I had the good fortune of being trained in extraoral injections, states in his book on regional anesthesia, "The presence of some anesthetic fluid in a human body is not always followed by anesthesia but its presence in the correct place will never fail to produce the desired results." Anesthesia failure is mainly due to imperfect technique. We often hear patients say, "The needle has no effect on me. I must have gas." This opinion is not alone held by the lay patient. A short time ago a reputable physician was referred to me by his dentist for the anesthetization of the mandible for cavity preparation. He gave just such a history. He had had about four teeth removed at various intervals and numerous attempts made for operative procedure and never had complete anesthesia. He told me that only once anesthesia was fairly successful and that was many years ago when a medical confrere of his, who taught anatomy, obtained partial anesthesia of the inferior alveolar nerve after five attempts. This man told him he had an aberrant nerve and to this day the physician felt he was one of nature's freaks and his alveolar nerve did not run in a normal path. He was willing to have me attempt to anesthetize him as I told him I had never seen a patient, nor had I ever read of a patient, with an aberrant inferior alveolar nerve. Needless to say, he was very skeptical, but, fortunately, I was able to convince him he was normal. Failures with the inferior alveolar nerve or, using the old terminology, mandibular nerve (which is a misnomer as we are not injecting the mandibular nerve but only a branch of it, the inferior alveolar, as it enters the inferior alveolar canal) are due to injecting too high, injecting too low, injecting too far posteriorly, or too far medially.

Injecting too high we obtain anesthesia of the buccinator nerve and not the inferior alveolar. This misunderstanding is easily explainable. When the operator injects too high, invariably when asked if there is a numbness of the lower lip, the patient will answer in the affirmative. Thus the operator may believe he has anesthesia of the part. This error in technique is brought about in the following manner. In making the injection we like to have the patient's mouth open to the fullest extent. Patients are rather apprehensive, and when the operator approaches them with the needle there is a tendency for them to close their mouths. After the initial insertion of the needle the mouth is closed still further. The operator, in his desire to proceed into the deeper structures, by this time can no longer visualize his field and tells the patient to open wider. In opening the mouth wider the structures are stretched and pull the needle upward and forward. In this way the solution is deposited too high, anesthetizing the buccinator nerve. However, if we check carefully with the patient as to numbness we will find it only on the corner of the mouth extending a few millimeters on the lower lip and a few millimeters on the upper lip. We know

that the anesthetization of the inferior alveolar nerve will produce numbness on the lower lip all the way to the midline.

If we inject too low we anesthetize the mylohyoid nerve, and the patient will complain of difficulty in swallowing. If we inject too far medially we may inject the internal ptyergoid muscle resulting in partial trismus and postoperative pain. The solution will be deposited too far from the inferior alveolar nerve, and by the time some of the solution is absorbed by the nerve, it will be too weak and not sufficient in quantity to produce complete anesthesia. If the injection is made too far posteriorly, we may inject the parotid gland and also the facial nerve which will give us symptoms of a Bell's palsy, drooping upper lip and failure to close the eyelid on that side. The injection of the solution in a blood vessel in that region will result in blanching of the skin in the infraorbital region and possibly toxic reaction to the drug such as syncope, shock, collapse. We know that drugs deposited in the arteries are about four times stronger and, if deposited in the veins, sixteen times stronger—more toxic than if injected subcutaneously.

Another injection with which we might have some difficulty is the posterior superior dental or, using the old terminology, the tuberosity injection. This is one time in dental practice when we do not want our patient's mouth wide open. By having the mouth slightly open we are better able to retract the tissue and, by keeping the index finger well under the zygomatic arch, retracting the soft tissue and, by the proper direction of the needle upward, inward, and backward, we will avoid injecting into the cheek. As you know, in this region there is a fatty pad of tissue commonly called the sucking pad or corpus adioposum buccae, as the anatomist calls it. This tissue is practically devoid of circulation. Depositing the solution in this fatty pad will cause it to act like a sponge, swelling up and giving us a tumor of the face. If we have pierced a blood vessel we will have an accompanying ecchymosis which, if no infection has been introduced, will be of no consequence other than disturbance to the patient for a week or ten days. The fact that we have injected in the cheek, however, means that we have made a perforation with the needle in the mucous membrane of the cheek, an area we did not intend to inject and, therefore, did not fix with sterilizing solution. That is the reason for the frequency of infection accompanying swellings in this area.

Postoperative sequelae are greatly lessened today by the improvements in technique and armamentarium. We have syringes today which are devoid of rubber washers or the glass barrels which were so leaky and easily broken; all-metal syringes can be boiled, and boiling is still the best means of sterilization. We have gotten away from the old suspension jars with glycerin and alcohol thus avoiding the possibility of depositing traces of alcohol with anesthesia which resulted in prolonged numbness of the part. The needles are improved, annealed stainless steel, which bend without readily breaking. Fortunately we do not see nearly so many broken needles today, and I believe it is due chiefly to the operators' improved technique. If one uses any rust-preventing substances in sterilizers, a separate sterilizer should be used for needles and syringes. This will prevent the deposition of any of these substances in the soft tissues, which might be a factor in some postoperative reaction. These

sterilizers are inexpensive today and within the means of every one. Solutions as prepared today by reputable manufacturers are more aseptic and more constant in concentration than those used when each man prepared his own solution. Grossman and Appleton,[3] in a bacteriologic study of fifty-one local anesthetics as manufactured today, found a high degree of sterility due to the antibacterial properties of procaine and suprarenal extracts. However, they warn us not to rely on this as a substitute for aseptic handling.

Postoperative pain, slow healing, inflammation are often attributed to local anesthetic solutions when they are the results of operative trauma. Accidents and infection following local anesthesia may be due to:

1. Break in chain of asepsis. The operator may be very careful in his original injection with properly fixing the bacteria on the surface, yet, on testing of the mucous membrane as to whether anesthesia is present, he may fail to follow the same careful procedure when he reinjects to augment anesthesia.

2. Injection on the lingual surface of mandibular molars, particularly in the presence of a pericoronal infection. Directly posterior to the third molar region on the lingual aspect is a space first named by Dr. Leo Winter[4] in his *Textbook of Exodontia.* This space contains little but connective tissue. An instrument placed in this space will come directly to the outside of the face below the angle. Dr. Winter named this space the retropterygoid space. Should purulent material be forced into this space, as is easily feasible from an injection in the lingual surface of the third molar, an infection will result which will necessitate incision and drainage extraorally at the angle of the jaw. Also by injecting the mucous membrane on the lingual surface of mandibular molars we can readily injure the lingual nerve which runs a short distance below the neck of the third and second molars. This will cause prolonged paresthesia of the tip of the tongue.

3. Pain may follow the use of local anesthesia when the injection is made too rapidly or with too great pressure, where dull needles have been used, or where an inflamed area has been injected.

4. There or four days following the removal of a tooth where inferior alveolar injection was made, the patient may return with difficulty and pain in swallowing and partial trismus. A careful examination of the mouth may reveal a normally healing socket. We must then think of the possibility of a soft tissue infection. The patient should be advised to use a hot saline irrigation, not with a glass but with an irrigating syringe every hour. (Two quart enema bag or fountain syringe.) The tube should be placed underneath the tongue as far back as the mandibular third molar region. This will do one of two things: either resolution will take place or the symptoms will be aggravated and, after several more days, fluctuation will be present. Associated with the local symptoms there may be present the systemic symptoms that accompany any infection such as irregular pulse, fever, constipation, coated tongue, etc. Where trismus and difficulty in swallowing are present general anesthesia should not be used as there may be edema of the glottis present. The mouth should be forced open without any anesthetic and fluctuation sought for lingually to the third molar and posteriorly in the tonsillar region. Where fluctuation is present, the tissues can be readily punctured with a blunt instrument, such as a hemostat, and the lips of the wound spread, establishing drainage. The hourly irrigations should

be continued for a few more days until the symptoms are relieved. There are times when the edema will gravitate extraorally below the angle of the jaw. Cold external applications should be discontinued and heat used—hot magnesium sulphate wet dressing or flaxseed poultice to localize fluctuation extraorally. Incision and drainage should be established. This fluctuant area can be successfully anesthetized for incision and drainage by the Schliech Method. The skin is prepared for surgery, washed with tincture of green soap, wiped with alcohol and then painted with iodine. Holding the skin between the thumb and index finger at the point of penetration of the needle at the outer edge of the swelling will permit its insertion rather painlessly. The point of the needle should not be inserted any deeper than the subcutaneous tissues. A few drops of the anesthetic are deposited, and the needle is glided along the circumference edge of the swelling, injecting as we proceed, creating a wheal. The needle is then withdrawn and reinserted at the farthest point where the dermis was infiltrated. In this way the entire area can be whealed without injecting directly into the infected area.

There is a great deal of confusion today with the increase in many different types of anesthetic solutions on the market by manufacturers who are trying to improve the solution or trying to dominate the market with their particular type of anesthetic. In the past few years the literature has been swamped with both laboratory and clinical investigations of these numerous solutions. The reader, trying to analyze their findings, is left perplexed by their different discoveries and claims. A few years ago a great deal was written about the hydrogen-ion concentration of solutions. Claims were made that the manufactured solutions were too acid, the hydrogen-ion concentration too low. The hydrogen-ion concentration should be at least that of our blood, 7.4, or even higher, making it an alkaline solution. Manufacturers put out buffered solutions which were soon found to be unstable so that now they have separate carpules of sodium borate which is added to our anesthetic solution just before we make our injection. Claims were made for this solution saying it would produce quicker anesthesia, minimize postoperative reaction. S. B. Fontaine of California states that, "Novacaine solutions which have a hydrogen-ion concentration below 6 should not be used as they are irritating to the tissue and serious tissue reactions make a nidus favorable for infection."

However, Leo Winter,[4] professor of New York University College of Dentistry, John Lundy[6] of Mayo, Tainter[5] of San Francisco, and others found, by clinical application of the two solutions, that there is no advantage of one over the other. The tissues are so well buffered that injections of small quantities of local anesthesia used in dentistry are not sufficient to modify the local hydrogen-ion concentration. The hydrogen-ion concentration of the blood is 7.4, but we do not inject into the blood, and that our tissues are constantly in a state of metabolism indicates that tissue hydrogen-ion concentration is lower than that of blood. In the New York University College of Dentistry we have, in the clinical applications, found no difference between the solutions of the various hydrogen-ion concentrations.

In perusal of the literature one is left with a great deal of uncertainty as to the effects and reactions of procaine and epinephrine and other substitute

vasoconstrictors on patients' pulse and blood pressure. About five years ago, cobefrin was introduced to the market. Cobefrin 1:10,000 in combination with procaine instead of epinephrine was to eliminate on certain individuals reactions that had often been ascribed to epinephrine combination. Soon there were claims and counterclaims made for the efficacy of this combination. Experimentally, in 1938, Tainter and Throndson[8] and Tainter, Throndson, and Moose[9] found that equal volumes of anesthetic containing cobefrin, neosynephrine, and 1:50,000 of epinephrine, when injected intravenously, resulted in a greater rise in blood pressure and pulse rate when cobefrin and neosynephrine were used. When injected intramuscularly and subcutaneously, the same solutions increased the circulation only slightly. In a subsequent paper several months later the same authors reported that, from a clinical study of these same solutions, the reactions were more marked with epinephrine than with the other vasoconstrictors, cobefrin and neosynephrine—exactly opposite findings than in their experimental report.

Now we read a great deal about another solution, monocaine, which is a comparatively new product to replace procaine, and which is not supposed to have the toxic effects that procaine has. Monocaine is used synergistically with a very mild solution of epinephrine. We read that monocaine will give quicker, more profound anesthesia than procaine epinephrine, also that, like procaine cobefrin, it will not cause any reaction on patients and can be used freely on patients with cardiac disease, hypertensive patients, those with hyperthyroidism, etc. Here we see one substitutes cobefrin for epinephrine because epinephrine is blamed for toxic reactions, another substitutes monocaine for procaine because of the procaine toxicity.

Tainter and Throndson[8] however, have shown that procaine without a constrictor has no effect when used in rather large volume when injected intramuscularly or subcutaneously, as the body can detoxify procaine at an extremely rapid rate. It is destroyed as fast as it is absorbed from the muscle.

I could go on and on citing the literature as to what reaction these drugs have or do not have. Let me give you my impression from a clinical application of these various solutions. I have found no difference between the procaine-cobefrin 1:10,000, the 1 per cent monocaine-epinephrine 1:75,000 or 1:100,000, and the procaine-epinephrine 1:50,000 or 1:60,000. They will all give the same profound anesthesia and practically no reaction aside from those that may be attributed to psychic disturbance on the part of the patient. You may have a little more bleeding from procaine cobefrin than from the other, but that may be an advantage rather than a disadvantage, the bleeding never being severe enough to interfere with any surgery you may be doing.

In a study of 181 hospital cases Borg[10] found that by using the blood pressure and pulse as recorded in the hospital chart for that day frequently the pulse rate increased from ten to twenty beats as soon as patients became aware of the impending extraction, and before any solution was injected. He found no consistent change of rate and blood pressure following anesthetic solution. It seemed reasonable to assume that many variable changes were due to other conditions such as psychic and tension of patient rather than small amounts of the drug.

The following preliminary summary of a study of patients with cardiac disease from Montefiore Hospital, although from the viewpoint of the surgical risk of the patient to dental surgery, will give you our findings of their reactions to local anesthetics. The patients selected were all hospital patients, and we purposely omitted those from the out-patient clinic because of the possible inaccuracy of checkups.

There is a total of 215 patients with cardiac disease on whom over 1,100 teeth were removed over a ten-year period. The study consisted in checking our dental records as to any immediate reaction to the anesthetic and necessary surgery performed. The medical history, nurses' cards, and temperature charts were then checked. There were:

141 extractions using as an anesthetic procaine 2 per cent without any epinephrine.
375 extractions using procaine 2 per cent and cobefrin 1:10,000.
373 extractions using procaine 2 per cent and epinephrine 1:50,000.
178 extractions using procaine 2 per cent and epinephrine 1:60,000.
60 extractions using monocaine 1 per cent and epinephrine 1:75,000.

Our findings strongly support my clinical impression. There was no difference in the patients' reaction to one anesthetic over the other. There was practically no reaction on any of the patients that could be directly attributed to the anesthetic used. The fear of using epinephrine as a synergist with procaine is unfounded and a myth.

I can readily appreciate the fear of even the physician when his patient with cardiac disease is referred for exodontia and understand his warning the dentist not to use any adrenalin. The physician in using adrenalin, whether in his treatment for asthmatic attacks or even as a heart stimulant, thinks of adrenalin in 1:1,000 strength. He has no hesitation in using 1 c.c. dosage or even in repeating the dosage. One cubic centimeter is approximately 15 minims. Now, if we were to use one minim of adrenalin to 2 c.c. of procaine, we would have adrenalin 1:30,000. Our anesthetic of procaine 2 per cent and epinephrine 1:50,000 or 1:60,000 means we use less than one minim of this vasoconstrictor drug, and this, I firmly feel, is too infinitesimal an amount to play any part in reactions of patients.

I have found that anesthesia with procaine epinephrine in small quantities, such as 1:50,000 or 1:60,000 will be just as prompt and profound as with solutions of greater percentages of epinephrine, and I can see no reason for the need of ever using any stronger percentage of epinephrine in our dental surgery. Higher concentrations of epinephrine may be a factor in certain varied reactions on some patients.

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Case Reports

The editor will add in this issue to the case reports a case which is of interest to the oral diagnostician.

Case reports for this section of the Journal should be sent to Dr. Kurt H. Thoma, 53 Bay State Road, Boston, Mass.

CASE REPORT NO. 41

CALCIFICATION OF THE STYLO-MANDIBULAR LIGAMENT

KURT H. THOMA, D.M.D., BOSTON, MASS.

IN 1932 a patient was seen who came to me complaining of pain on extensive excursions of the jaw, particularly when made in a lateral direction. His pain was located posterior to the ramus on both sides.

X-ray Examination.—The x-ray examination showed an edentulous mandible with calcification of the stylo-mandibular ligament. This ligament is an accessory ligament of the mandibular joint and consists generally of a fibrous cord attached to the styloid process and extending to the posterior border, and in some cases to the angle, of the jaw. The styloid process is frequently en-

Fig. 1.—Calcification of the stylo-mandibular ligament.

larged because of calcification of the ligaments which are attached to it. This causes an extension of the process which occasionally is found to reach into the tonsils or the anterior pillar, causing painful deglutition and interfering with the motion of the jaw in mastication.

The normal stylo-mandibular ligament is not visible in the x-ray, but with calcification it is plainly outlined, as seen in Fig. 1.

Department of Orthodontic Abstracts and Reviews

Edited by

DR. J. A. SALZMANN, NEW YORK CITY

All communications concerning further information about abstracted material and the acceptance of articles or books for consideration in this department should be addressed to Dr. J. A. Salzmann, 654 Madison Avenue, New York City.

Treatment of Muscular Dystrophies and Allied Conditions. Preliminary Report on Use of Vitamin E (Wheat germ oil): By Simon Stone, M.D., Manchester, N. H., *J. A. M. A.* **114**: 2187-2191, 1940.

The possibility that muscular dystrophy in the human being was related to the type of muscular dystrophy observed in the guinea pig and rabbit maintained on a vitamin E deficient diet suggested the investigation of the influence of the addition of vitamin E (wheat germ oil) to the regular diet of a number of patients with muscular dystrophy and muscle atrophy. The patients consisted of a group of children with dystrophies seen at the Crippled Children's Clinics of the State of New Hampshire. Most of the patients were ambulatory, and three were hospitalized for observation for a short time. The group included thirteen patients with muscular dystrophies, one patient with muscular atrophy following anterior poliomyelitis, and one patient with advanced muscular atrophy coming on after an attack of neuromyeloradiculitis. In seven cases the treatment has progressed long enough for one to form definite conclusions as to the results.

It was found expedient and less expensive to administer the oil in milk or with the food instead of in capsules, and the dosage was also increased to 10 minims (0.6 c.c.) three times daily. The addition of yeast tablets to the diet and the increase in amino acid intake through daily feedings of gelatin have also brought a more rapid response for the better. At present the oil is administered in a mixture with liquid vitamin B complex, with which it forms an imperfect emulsion, simulating in taste malt and cod liver oil mixtures. Each gram of the oil is standardized to contain 2 Evans-Burr units of vitamin E, and the usual dosage is 4 c.c. from three to four times daily, of one to seven parts suspension of wheat germ oil in vitamin B mixture. The patient thus receives about 2 c.c. daily of wheat germ oil, together with an ample supply of the vitamin B complex.

The response to treatment is usually prompt. At first improvement in appetite is noted, then disappearance of pain on exertion, followed by greater resistance to fatigue and lastly by replacement of rubbery muscles by normal muscle tissue. Rise in growth and weight was noted in all the younger patients, and also an increase in the sense of well-being. The medication in the present form is usually well tolerated by all patients.

In cases of muscular dystrophy of long standing with contractures and deformities, the concentration of the oil in the mixture has been increased, the patient thus receiving from 4 to 6 c.c. of wheat germ oil daily. No unpleasant after-effects have been reported by the patients receiving this stronger mixture.

Five patients with muscular dystrophy, one patient with muscular atrophy following anterior poliomyelitis, and one patient with muscle atrophy after an attack of multiple neuritis or neuromyeloradiculitis were treated with vitamin E (wheat germ oil).

Definite improvement was obtained in all cases with muscular dystrophy, the improvement being manifested in gain in muscle strength, the disappearance of fatigue and muscle pain on slight exertion, change in muscle texture, and displacement of dystrophic musculature by normally contracting muscle tissue.

In the cases of muscular atrophy following involvement of the nervous system, increase in amount of regeneration of muscle tissue became apparent after the addition of vitamin E (wheat germ oil) to the vitamin B complex the patients were receiving.

The addition of vitamin B complex to vitamin E appeared to increase the therapeutic efficaciousness of the latter.

Notes on Surgical Procedure in Orthodontic Treatment: By S. A. Riddett, L.D.S., *The Dental Record* **40**: 134-148, 1940.

Among the surgical operations in orthodontic treatment discussed by Mr. Riddett are complete section of the body of the mandible in prognathisms and micrognathisms and section of the rami of the mandible in open-bite cases.

When dealing with deeply impacted teeth the author finds it best to lay back a rather large flap of the overlying gum tissue, chisel away the overlying palatal bone from the crown surface and to pack the opening with acriflavine and paraffin. This packing is subsequently changed to one of gauze steeped in zinc-oxide paste. At a later date a vulcanite plug may be fitted around the exposed crown of the impacted tooth. The tooth is thus encouraged to erupt against the pressure created by the vulcanite plug.

The author describes a case of a girl, aged 10 years, who, when first seen, was wearing a retention plate which carried a small hook arranged to pass below the incisal edge of the maxillary left central incisor. When this tooth first appeared it came through the gum pointing horizontally forward. An appliance had been worn to bring the tooth down into its correct position. When the child was first seen the tooth was in almost normal alignment.

Whenever the retention plate was not worn for a day or two, however, the tooth at once began to travel out again, and the girl had some difficulty in getting the plate in on those occasions. On examination, he discovered that the frenum was attached to the gum directly over the center of the incisor concerned, the attachment extending to the gingival margin. He separated the frenum from its attachment to the gum over the root of the tooth and removed the portion thus set free. The retention plate was not worn again and the tooth did not relapse. He felt convinced that this particular case was an instance of cause and effect.

Effects of the Symmetrical Extraction of Six-Year Molars: By Dr. C. Jordan-Winkler, Zurich. Reports, Papers and Demonstrations. European Orthodontic Society Bonn-Wiesbaden, 3.—6. VII, Pp. 40, 41, 1939.

The symmetrical extraction of the six-year molars, as suggested by orthodontists and then abandoned, was constantly recommended by school dentists as a means of preventing caries. The extraction of the six-year molars is supposed to do away with crowding of the teeth, thereby creating favorable space conditions and lessening the danger of caries. Clinical observations as well as statistic investigations support these contentions. My investigations on this question rely upon casts, radiographs, and profile pictures, which were produced both some days before the symmetrical extraction and about three years later.

The comparison of the findings in the maxilla and mandible gives the following results:

1. A slight reduction in small anomalies;
2. A relaxation in the position of the front teeth and
3. Mainly of the side-teeth with now and then too great a space formation;
4. Pronounced turning movement in the teeth
   a. in the second molars 75 to 80 per cent;
   b. in the second premolars 60 per cent;
   c. in the first premolars 60 to 65 per cent;
   d. in the front and canine teeth circa 20 per cent.

An improvement in already existing "turnings" through removing imbrication can be noticed up to about 5 per cent.

5. As unfavorable phenomena tilting, principally in the second molars; in the mandible 100 per cent, in the maxilla around 60 per cent, the second premolars in the mandible (75 per cent) also stronger again than in the maxilla (60 per cent), the canines and the first premolars about the same above and below, i.e., around 35 per cent and 55 per cent, respectively.

6. Sagittal abbreviations of the dental arch more pronounced in the maxilla than in the mandible.

7. Closure of most extraction spaces in maxilla, but only in a few cases in mandible.

The occlusion, which was examined in the contact of the cusps and the collective action of the teeth in their masticating surfaces, shows a deterioration in the region of the second molars (headbite to distoclusion position), an inclination of the front of the maxilla and a fairly extensive loss of masticating surface.

An attempt is made to explain the stronger mesial movement in the maxilla than in the mandible.

The skiagrams give a clear insight into the nature of the unfavorable tilting already noticed. An alveolar bone-decay is apparent mesially and distally from the extraction space, which can be regarded as the place of least resistance for paradentosis.

The profile pictures of the patients were examined only with regard to alterations in the mouth: the angle of the lip tangents is reduced, the nose base

increased, the upper lip runs more to the rear, the chin protrusion appears stronger, the nasolabial fold is particularly pronounced.

All these changes are more pronounced in the female than in the male.

Our examination of models of the jaw and skiagrams shows: spaces, turning and tilting of the teeth, causing reduced contraction of the masticating surfaces, and at the same time increased susceptibility to paradentosis. Profile alterations confirm the sagittal abbreviations of the dental arches with their more or less pronounced and obstructive growth influences on the upper and lower alveolar ridges respectively.

In consideration of these constantly recurring unfavorable consequences of symmetrical extraction is it permissible to aim at a merely problematic reduction of the tendency to caries in this way, even if a social indication is present?

This reviewer has shown that extraction, per se, is never a justifiable therapeutic measure, unless orthodontic treatment is instituted to control subsequent drifting of the adjacent and other teeth in the mouth.

Biteplanes Out of Silver-tin: By Dr. W. Schmitz, *Zahnärztl. Rundschau,* No. 19, 1940.

In order to obtain an inclined plane which could be cemented on the mandibular incisors in cases of prognathism or linguoversion of the maxillary incisors, silver had been used hitherto because this material, with its ability of being easily manipulated and with its sufficient hardness, has met all requirements. Lately a substitute of silver and tin or even pure tin has been used. The possibility to work with this is also good. (It may be even more comfortable because of the lower melting-point of tin.) However there appear to be deficiencies insofar as the material is not sufficiently hard. Especially in the case of strong canines. Biting into the inclined plane by the tooth to be moved causes a sulcus to form in the plane with the result that the effect of the plane is lost. The grooving of the inclined plane can be overcome by frequently repeated grinding which, however, may result in a perforation of the inclined plane so that it becomes useless.

In order to overcome the grooving of the inclined plane, the following is suggested: one or more flat stainless steel band material strips, according to the position and number of teeth to be corrected, are bent and inserted into the waxed inclined plane of the biteplate. For increased support of the metal strips retaining wires are soldered to the band material strips and imbedded in the waxed biteplate.

Results of Facio-Hypoglossal Anastomosis in the Treatment of Facial Paralysis: C. C. Coleman, M.D., *Ann. Surg.* **3**: 958-970, 1940.

Coleman notes that surgery of the facial nerve may be required for the restoration of function when the nerve is paralyzed from trauma or disease and to reduce or abolish function when the muscles it supplies are involved in severe spasm. The most conspicuous feature of the deformity of unilateral facial paralysis arises from the displacement of the mouth by unopposed contraction

of the muscles of the healthy side, whereas the alteration of facial appearance caused by paralysis of other muscle groups, such as those of the upper lip, eyelids, and brow, is not exaggerated by the activity of the muscles on the normal side.

Reconstructive operations such as decompression of the nerve in the bony canal, direct suture and nerve graft have been advocated (Bunnel, et al.) for lesions in or peripheral to the bony canal, when the location of the lesion is favorable for such procedures. The author, from his personal experience, feels that suture and graft of the trunk of the facial nerve fail to restore emotional expression or to prevent mass movements of the face. This failure is due to defective regeneration of the nerve. On the other hand, the results are much more favorable after the successful repair of one or more peripheral branches of the facial nerve.

According to Coleman, anastomosis of the facial nerve with another motor cranial nerve is the only procedure which will restore innervation to the paralyzed facial muscles following an intracranial lesion of the nerve. Facio-hypoglossal anastomosis will restore movement in practically every case. However, function of the muscle groups, after facio-hypoglossal anastomosis, cannot be individualized. When the patient responds to emotional stimuli the expression of emotion is registered only on the healthy side; smiling is accompanied by slight deviation of the mouth to the healthy side.

Although anastomosis requires the sacrifice of another cranial nerve (the hypoglossal), the resulting atrophy of the tongue causes no appreciable interference with speech or deglutition. The results of the anastomosing operation can be greatly improved by voluntary suppression of facial movements and emotional expression on the normal side. According to Brown, incomplete recovery and residual paralysis of important muscle groups, may be improved by supporting the face with facial strips. The author feels that this combination of nerve anastomosis and facial support gives the best result and should be used much more frequently. The author then describes the technique of the operation in detail. The text is illustrated by photographs of patients before, and at various periods after the operation. Semidiagrammatic drawings show the relationship of the nerves in question as well as the method of approach for accomplishing the anastomosis.

One must bear in mind, however, the fact that maximum recovery following all operations leaves much to be desired, and that the patient's facial appearance is never restored to normal. Facio-hypoglossal anastomosis for the relief of paralysis following intracranial lesions of the facial nerve will balance the face in repose, restore movement of the paralyzed muscles, and prevent further disfigurement resulting from atrophy of the muscles.

Harry A. Salzmann, M.D.

Book Reviews

Babies Are Human Beings. An Interpretation of Growth: By C. Anderson Aldrich, M.D., Assoc. Prof. of Pediatrics, Northwestern Univ. Med. School, and Mary M. Aldrich. Pp. 128, Price $1.75, New York, 1938, The Macmillan Co.

Your Child's Development and Guidance Told in Pictures: By Lois Hayden Meek, Ph.D., Formerly Director, Child Development Institute and Professor of Education, Teachers College, Columbia University. 101 photographs, 62 live drawings. Pp. 166, Price $2.00, Philadelphia, 1940, J. B. Lippincott Co.

Let's Talk About Your Baby: By H. Kent Tenny, Jr., M.D., F.A.A.P., Assoc. Prof. of Pediatrics, Univ. of Wisconsin Medical School, Associate Pediatrician to the State of Wisconsin General Hospital. With a Foreword by Dr. Joseph Brennemann, Chief of Staff, Children's Memorial Hospital, Chicago; Minneapolis, 1940, The University of Minnesota Press.

The Aldriches have managed to write a book for parents from a practical pediatric standpoint. They have drawn freely from the works of Gesell, Scammon, Todd, Preyer, and others, with the result that the simpler and more relevant facts of growth are presented in simple language for lay persons, in order to enable them to understand babies.

Parents are admonished by the Aldriches to do "something" about the baby's thumb-sucking in order to avoid a large orthodontist's bill. While this is, indeed, a valid reason why the baby should not be permitted to suck his thumb over a long period of years, we could give more valid reasons for stopping the habit. There are hygienic and esthetic reasons why the thumb-sucker should be broken of the habit. It is worthwhile mentioning here that even orthodontists are prone to ignore the unsanitary aspect of thumb-sucking.

Orthodontists will find Dr. Meek's book of more than passing interest. This author begins where the previous ones left off and discusses the child up to primary school age. Here again, in this volume, growth and development come in for much intelligent discussion. Methods of obtaining height and weight of children are provided. The skeletal system is touched upon.

Meek has written an unusually good chapter on tooth development in relation to general growth. The fact that the period of calcification of the teeth extends from the tenth fetal month to the eighteenth year is stressed as is the fact that tooth eruption takes place at various intervals from six months to the twentieth year.

Although dentists are diffident about telling laymen what makes healthy teeth, Meek shows no hesitancy in giving five factors upon which healthy teeth depend: Inheritance, prenatal diet of the mother, infant diet of the child, mouth hygiene, and general health.

Tenney has written a little volume that contains much useful information which he has seen fit to hide behind a great deal of purported *baby talk*. However, once you get past the "humor" the rest is really interesting and worthwhile. The question of teething is touched upon and parents are warned against regarding all illnesses of childhood as "nothing but teeth." Orthodontists who are desirous of knowing babies better will do well to become acquainted with these books.

Editorials

Head and Face Surgery Units

NOW that the President has petitioned Congress for authority to call out the National Guard, now that a Pan-American Conference has just been concluded, and the situation in Europe as related to the Western hemisphere is such as it is at this time, mobilization is at least on the way in America.

One of the essentials of preparedness is provision for an adequate medical service in all of its ramifications. It is not only a matter of justice to the officers and men who sustain wounds in the defense of their country, but one of policy, since the salvage of human lives not only sustains the morale of fighting forces but also preserves *esprit de corps*. Each army and every large naval force includes a complete medical organization consisting of officers selected from competent members of the profession and other personnel to assure proper application of proper medical service. Since the regular Army and National Guard in times of peace are comparatively small and must be enlarged for an emergency by organized and untrained reserves, it follows that many civilian professional men will be required to provide for the needs of the sick and wounded, as was the situation after our entry in the previous World War.

At the time of World War I, the machinery for proper selection and assignment of about 40,000 men from the professions in civilian life was not well organized, with the result that qualified specialists were given duty in ambulance units, recent graduates were sometimes placed in large hospitals and the zones behind the firing line, while elderly men were sent to the front. It can be concluded that with the appointment of Major General James C. Magee as the Surgeon General of the Army such mistakes will not be repeated in a future national emergency. This is evidenced by the fact that this distinguished representative of the War Department has set in motion the machinery for the purpose of obtaining a card index of the physical and professional qualifications of all in the United States likely to be called into this department of service.

This is a commendable step in preparedness which will, no doubt, be applauded by every patriotic citizen. It will be recalled that both General Gorgas and later his successor, General Ireland, in the office of Surgeon General of the Army during and soon after the first World War realized the needs for rehabilitation of those left incapacitated from wounds or injuries and organized in the large medical centers both in France and at home distinct service for the purpose of restoring as many officers and men as possible under the limited facilities then available.

Among these were the units for head and facial surgery that made such outstanding contributions to humanity, particularly at Walter Reed Hospital in Washington. In recalling this activity, it has been interesting to thumb the back volumes of the AMERICAN JOURNAL OF ORTHODONTICS AND ORAL SURGERY and again refresh the memory and note the fine contributions printed in 1921-

1922. Dr. Joseph D. Eby, a New York orthodontist, and former president of the American Association of Orthodontists, was a notable contributor to the literature at that time as a result of his vast experience during the war and his subsequent long service in this work at Walter Reed Hospital.

It was amply proved at that time that orthodontists as a group, particularly on account of their experience and training, are adept in coordinating themselves into the complex field of the repair of head and face injuries. Even so it seems much time is required and careful instruction and experience are necessary in order to teach the average practicing orthodontist the more advanced and modern mechanical technique that has been developed and refined for supplementing head and face surgery, so much of which is necessary during war time.

With Brigadier General Fairbank, a widely experienced orthodontist, at the head of the dental corps, it seems reasonable to presume this particular branch of war surgery will be far better set up with a carefully trained personnel than it was in the first World War, and that the combined hook-up of the treatment of head and face injuries, in conjunction with modern mechanical technique now available and developed, will make a still greater contribution to the benefit of mankind than it has in the past.

H. C. P.

The Ketcham Award Is Conferred Upon Dr. George Grieve of Toronto, Canada

THE American Board of Orthodontics conferred upon Dr. George W. Grieve, Toronto, Can., the Albert H. Ketcham Award for 1940 at the regular annual session of the American Association of Orthodontists, held in Chicago in May, 1940.

The honor was tendered Dr. Grieve for his outstanding contributions to the advancement of orthodontics as a specialty of dentistry.

The American Board of Orthodontics was created by the American Association of Orthodontists in 1929. Dr. Ketcham, of Denver, Colo., was the inspiration for the formation of the Board and became its first president, a position which he held until his death in 1935. Certification by the Board designates the orthodontic specialist as qualified in the art and practice of orthodontics and approved as to ability by a board created within his own specialty.

Subsequent to Dr. Ketcham's death the board, in an effort to commemorate his constructive activities, in conjunction with the American Association of orthodontists, established the Albert H. Ketcham Award. This award is conferred annually upon an orthodontist who has made outstanding contribution to the science and art of orthodontics during the current year or in some previous year. The Award Committee consists of three members of the American Board of Orthodontics and two members of the American Association of Orthodontists.

Those who have previously received this award are Dr. John A. Mershon of Philadelphia, 1937, Dr. Alfred R. Rogers, Boston, 1938, and Dr. Milo Hellman, New York, 1939.

The remarks of Dr. Harry E. Kelsey on behalf of the Board in making the presentation to Dr. Grieve follow:

Remarks of Dr. Harry E. Kelsey on Presenting The Albert H. Ketcham Award

Mr. President, Members of the American Association of Orthodontists, and Members of the American Board of Orthodontics:

Again it becomes my pleasant duty to present to you a recipient of the Ketcham Award. As in the past, the committee, whose duty it is to make this selection, has done its work well and upon being notified that the choice this year had fallen to one of the oldest and most helpful members of the American Association of Orthodontists, Dr. George W. Grieve of Toronto, Can., I felt an immediate enthusiasm for my task of preparing a brief introduction.

It is needless for me to say that Dr. Grieve in character and achievement fulfills to a marked degree the requirements of the Ketcham Award. You all know him and know of his outstanding contributions to orthodontics, and you also know of his unswerving and faithful devotion to the advancement of the American Association of Orthodontists. Not many of us have equaled his record of attendance at the meetings, and there has never been a time when called upon to contribute to a program that he has not responded and given the best that he had in him. Someone has said that "genius is the capacity for hard work," and if this be true, then we may say with perfect assurance that George Grieve is a genius. He is a man of strong convictions but his convictions have always been based upon deep study and thorough analysis of the subject in hand.

It has been customary in these presentations to give some history of the life and attainments of the Ketcham award recipient, and while I am familiar with his professional career, as all of us are, there was need for information as to his early life which I did not adequately possess. Therefore I asked Dr. Grieve to give some data which I could use to supplement his well-known professional achievements. He responded by writing me a letter concerning his early life and entry into the profession of dentistry and specialty of orthodontics, which to me is so interesting and throws so much light on the character of the man himself in overcoming handicaps and difficulties, that I take the liberty of quoting from it rather copiously, feeling sure that you will be as much entertained and interested as I was. I believe, furthermore that, as he himself suggests in the latter part of his letter, "It might prove a stimulation to young men to realize that *ambition* is a major factor in success."

Dr. Grieve says, "I had received the grand news from Charlie Baker, in a letter dated April 13, and it is rather surprising that I, who had experienced a coronary thrombosis a few years ago, survived the shock. My pleasure upon receiving this honor can only be exceeded by the love and harmony extant between my wife and myself.

"Permit me, Harry, to thank you sincerely for the very kind words of congratulation carried in your letter. I have already written Charlie, expressing my thanks to the members of the Board, as well as to the three members of the A. A. O. on the Award Committee. Now, for the information you desire to obtain for your encomium.

"I was born in Cobourg, Ontario, about 70 miles east of Toronto, on the shore of Lake Ontario, Sept. 18, 1870. My parents were both Canadians. My paternal grandparents came from England, maternal grandfather from Ireland, grandmother from U. S. A. All ancestors, with the possible exception of those of the American maternal grandmother, were originally Scotch. Of the forebears of my maternal grandmother I have no knowledge. At about 8 years of age I lost my father, and later my mother. I was placed with relatives on a farm near Cobourg.

"From this period forward, for a number of years, my life appears to have been *interesting*. In this farm home there was a very kindly mother, who was lovely to me, but she lived only about a year after taking me into her heart and her home. A grown-up daughter, possibly 30 years old, the eldest of three remaining at home, became the mistress of the house. She was not nice to me, and for about another four or five years I was not very happy. She had three brothers, all adults. I attended school—one and one-half miles distant—for about two years, and thereafter only during the winter. I did not get very far. I made several unsuccessful attempts to 'run away.' Finally, when only a little over 13 years of age, I succeeded in my 'get-away.' In place of building the fire in the kitchen stove, which was one of my many duties at that time, I put on two suits of clothes, such as they were—my whole worldly possessions—and 'skipped.' I had to 'borrow' two dollars from the family purse —my financial start in life. I walked the longer of the two routes (so that I might not be followed) to the nearest railway station, six miles, and a train ride of another seven miles put me in the town of my birth. I called upon some distant relatives there and they took me in. Next morning I went down to the main business street, and applied for a 'job' in every shop until I had gone a little more than a long block, when I entered a newspaper printing office, and here I got my 'first chance'—an opportunity to learn the printing trade, at a salary of $1.50 per week to start. A very kindly old lady, who kept a few boarders to help out her meager income, took me in as another, I to pay my $1.50 per week until I got an increase in wages, at which time I was to pay more. I did different things in the evenings, including selling Toronto papers on the street, to buy clothes which I needed badly. After a time my boss took me to an old-fashioned tailor, who made me a very nice suit, if not quite in style, at the 'boss's' expense. When I arrived from the farm the trousers I had were neither longs nor shorts, so an old-maid daughter of my kindly boarding mistress made shorts out of the halfway ones for me, and smartened me up considerably."

Dr. Grieve continued in newspaper or printing offices (with intervals of work in the summer on Canadian Pacific steamers) with increasing pay, during which time he learned to use the typesetting machines which were then coming in and later was given the machinist's job of looking after the fifteen machines in the office of the Montreal *Star*. He continued at this job for about a year and then returned to Toronto and attended evening classes in the Toronto Technical School preparatory to entering the Royal College of Dental Surgeons in Ontario in 1896, graduating from there in 1899 with the degrees of L.D.S. and D.D.S. The latter degree, he says, was granted by the University of Toronto since the Dental School was an affiliated college only and could not at that time grant the D.D.S. degree. He says, "Finances to

carry on during the college term were made up by money saved during the working years, some earned during the college summer seasons, and some borrowed from 'trusting' friends. During the final year at college my fees were covered by services in the infirmary."

GEORGE GRIEVE

Dr. Grieve then was offered and accepted a partnership in a well-established dental practice and during the next two or three years contracted the "orthodontic bug," the development of which he says was completed upon the occasion of Dr. Angle's presentation of a paper before the Provincial Dental Association and in the fall of 1907 he entered the Angle School at St. Louis. After receiving his certificate, he was offered the opportunity of taking over Dr. Angle's private practice in St. Louis but declined this offer as he wished to return to Toronto and in 1908 he commenced to practice as a specialist in orthodontics, and, to quote again, "for a very few years thought that I had the bull by the horns. I had gotten a splendid groundwork upon which to build, but I did not know how little I knew about orthodontia." And again, "After graduation from the Angle School I sat back for about ten years and listened to men

with more experience than I, but grasped every opportunity to seek information from individual men regarding my many troubles. Some men could solve my greatest problems for me in a few minutes, and often it required about a year for me to find out that their solution did not seem to work out very well. I had many disappointments, and at times was very much discouraged. On the other hand, there were those who really gave some thought to my requests for help, and from whom I received great assistance. Some of these men are still with us, but some others have gone. I shall mention, other than Dr. Angle, the names of only three men—Young, Ketcham, and Pullen. I had the opportunity, on many occasions of standing all day at the chair of J. Lowe Young, and of spending many evenings and Sundays with him. I shall ever feel grateful to the men who assisted me in those days, but most particularly to Angle and Young."

Dr. Grieve says he began to have the courage to attempt to say something himself about the year 1920 and from that time to the present he has been a consistent contributor to the literature of orthodontics. He has read papers before almost all of the orthodontic organizations of this country from coast to coast and several in Europe. One of his papers entitled, "Some Theories Obstructing Progress of the Science of Orthodontia" was read before the European Orthodontological Society at Zurich in 1930 and in 1931 he read a paper before the International Orthodontic Congress in London in the discussion of which I had the honor to participate. As with other recipients of this award, time does not permit the insertion here of a list of all of his writings but the above will show that the results of his long study and experience of orthodontic problems have attracted worldwide attention and the exposition of his ideas and opinions has met with a universal demand.

Dr. Grieve, or "Scotty" as his old friends love to call him, has almost become an institution in the profession. You may disagree with him, but it will not affect your friendship. He may prove you are in the wrong, or you may prove him to be wrong, and it still will not affect your friendship. If he has not arrived at a conviction regarding any professional procedure, he will tell you so and will do his best to get more information from you and everyone else on the subject, but if he has reached a conviction he will expound it fearlessly and with enthusiasm, whether his listeners are in agreement with him or not. His high moral and ethical standards and his unquestionable ability and notable achievements make his selection for the 1940 Ketcham Award singularly appropriate.

And now, Dr. Grieve, as President of the American Board of Orthodontics, I have the high privilege of handing to you this parchment on which is inscribed, "The honor signalized by the Albert H. Ketcham Memorial is hereby conferred upon George W. Grieve. This award is annually made in recognition of valuable contributions to the science and art of orthodontics." It is the tangible evidence of this award, and I am sure that the action of the committee in selecting you as the 1940 recipient meets with the cordial approval of every member of this association, and I am equally sure that if our former friend and confrere, Albert Ketcham (in whose honor this memorial was established), could be with us today, he too would be as happy as are we over your selection for this honor.

News and Notes

The Cleveland Meeting—A. D. A.—Sept. 9 to 13

Next month every member of the American Dental Association will be given the opportunity of attending the Association's annual meeting. This is also a privilege accorded our junior members. While the American Dental Association is at work every day in the year in the interest of the dental profession, it holds but one annual meeting at which it is the privilege of every member to be present.

The meeting this year promises to be one of unusual interest. Not only in March, but throughout the year of 1940, American dentistry is celebrating the centenary of its birth. It is around this theme that the program in Cleveland is being built. This will be emphasized in papers to be read on that occasion; also in bringing to Cleveland the historical exhibits which played so large a part in the success of the Baltimore celebration. Never in the history of the profession has there been brought together under one roof an historical exhibit of such widespread interest. Those who saw it at Baltimore will appreciate another opportunity to study it and those who were not so fortunate should regard this as a rare privilege.

A special effort is being made to make the section meetings of unusual interest to our members. These will cover every phase of dental practice. Each is in charge of a committee which has been at work for more than a year in an attempt to bring together at one time, the most modern knowledge available in the field of dentisry. These section meetings will provide a postgraduate course of incomparable value.

The general sessions, too, will be unique. Except for the necessity imposed upon the president, no dentist will appear on this part of our program. Following the invocation, the first session will be addressed by one of this country's most distinguished citizens, Senator James E. Murray of Montana. Senator Murray, who will speak on the subject of "General Health Legislation," has made a friend of every member of the dental profession by his introduction into the United States Senate of a bill to provide funds for dental research.

The Reverend Norman Vincent Peale, formerly of Ohio, and one of New York City's widely known clergymen and radio speakers, will speak on "The Art of Living." Dr. Peale is an inspiring speaker and will bring us a message which should encourage us to meet life's responsibilities in a changing world.

It would also seem to be appropriate in these troubled times when all that we have learned to revere is in danger of being uprooted, that we should be given an opportunity to listen to one whose worldwide experience as a foreign correspondent and lecturer, peculiarly qualifies him to interpret current events. This will be done at the second general session (Tuesday evening, September 10) by Mr. Frederic Snyder of Kingston, N. Y., who will speak on "Our Views and the Hour's News." I know Mr. Snyder personally and can testify to his qualifications for this assignment, for he is a magnetic speaker.

At the third general session, Dr. Earnest A. Hooton, professor of anthropology, Harvard University, will give an informal lecture illustrated with slides. Dr. Hooton is the author of the well-known book, *Apes, Men and Morons,* in which he emphasizes the importance of the human dentition in the preservation of the human race. We are fortunate indeed in obtaining Dr. Hooton's consent to speak to us on a subject on which he is a recognized authority. His subject will be "An Anthropologist Ruminates on Dentition and Devolution."

The Local Arrangements Committee, of which Dr. Gentilly is chairman, is sparing no pains to make the centennial celebration of the American Dental Association an outstanding event. For more than a year this committee has been at work preparing for a meet-

ing which promises to be without a parallel in the history of the Association. It will be unique in that it will celebrate the centenary of American dentistry. Only the attendance of our members in large numbers is needed to make this eighty-second meeting of the A. D. A. an unqualified success.

REMEMBER THE DATE: September 9 to 13, 1940.

ARTHUR H. MERRITT, President

Association of American Women Dentists

The Association of American Women Dentists will hold its nineteenth annual meeting in Cleveland, Ohio, on Sept. 9, 1940, at the Cleveland Hotel. An interesting and beneficial program has been planned and all members are urged to attend. All women dentists who are members of the A. D. A. are invited. The Association meets in conjunction with the A. D. A. meeting, Sept. 9 to 13. Headquarters will be at the Hotel Cleveland.

Great Lakes Association of Orthodontists

The fourteenth annual meeting of the Great Lakes Association of Orthodontists will be held at the Royal York Hotel, Toronto, Ont., Oct. 28 and 29, 1940.

RICHARD E. BARNES, Secretary

Denver Summer Seminar

The annual meeting of the Denver Summer Seminar for the study of orthodontics was held at the Broadmoor Hotel in Colorado Springs, July 8 to 14. The study included the following courses:

"The Fundamentals of Diagnosis in Dental Medicine," by Dr. Hermann Becks, professor of Dental Medicine, University of California.

"Orthodontic Techniques," by Dr. E. B. Arnold of Houston, Texas.

"Endocrine Function and Malocclusion," by Dr. R. G. Gustavson, professor of Chemistry, University of Colorado.

"Radiography," lectures and demonstrations, by Miss Lorraine Carpenter of Denver, Colo.

Case reports—one report presented by each member.

The Sixth Summer Seminar is scheduled to be held at the University of Colorado School of Medicine, Denver, during the last week of July, 1941.

Dean F. B. Noyes to Be Honored

Dr. Frederick B. Noyes, who is retiring as Dean of the University of Illinois College of Dentistry Sept. 1, will be honored at a testimonial banquet, sponsored by the Faculty of the College of Dentistry, at the Lake Shore Athletic Club in Chicago, Sept. 14. For further information or reservations please address the Chairman, Dr. Allan G. Brodie, or Dr. Stanley W. Tylman, 808 South Wood Street, Chicago.

Tenth Meeting of the Biological Photographic Association

The tenth annual convention of the Biological Photographic Association will be held at the Hotel Schroeder, Milwaukee, Wis., Sept. 12, 13, and 14. This society is interested in the further study of photography as applied to the biologic sciences, and the improvement

of its technique. Scientific photographers from all parts of the country will meet to exchange ideas and information on still and motion picture photography as well as the latest developments in color work. Formal papers will be presented outlining new methods of technique, and there will be informal round table discussions which will be especially instructive. Commercial firms specializing in the manufacture of scientific photographic apparatus and materials will exhibit and explain the use of their products. A salon consisting of natural color and monochrome prints of biologic and clinical subjects will illustrate a very fine degree of perfection in biologic photography.

Mid-Continent Dental Congress

The Mid-Continent Dental Congress will be held in St. Louis, Mo., at the Hotel Jefferson, Oct. 27 to 30, 1940.

Notes of Interest

Dr. Kennith J. Alley announces the opening of his office for the exclusive practice of orthodontics, 708 Equitable Building, Des Moines, Iowa.

Dr. Louis E. Yerkes announces the removal of his office to 825 Linden Street, Allentown, Pa. Practice limited to orthodontics.

Dr. Anthony Moore announces his association with Dr. David B. Hill, First National Bank Building, Salem, Ore., in the practice of orthodontics.

OFFICERS OF ORTHODONTIC SOCIETIES*

American Association of Orthodontists

President, Henry U. Barber, Jr. - - - - - 5 East Fifty-Seventh St., New York, N. Y.
Secretary-Treasurer, Max E. Ernst - - - 1250 Lowry Medical Arts Bldg., St. Paul, Minn.
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- - - - - - - - - - - - - - - - - - 292 Madison Ave., New York, N. Y.

Central Association of Orthodontists

President, Harold J. Noyes - - - - - - - - - 30 N. Michigan Ave., St. Paul, Minn.
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President, Leonard T. Walsh - - - - - - - - - - - Thatcher Bldg., Pueblo, Colo.
Secretary-Treasurer, George Siersma - - - - - - - 1232 Republic Bldg., Denver, Colo.

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***The Journal will make changes or additions to the above list when notified by the secretary-treasurer of the various societies. In the event societies desire more complete publication of the names of officers, this will be done upon receipt of the names from the secretary-treasurer.**

†The Journal will publish the names of the president and secretary-treasurer of foreign orthodontic societies if the information is sent direct to the editor, 8022 Forsythe, St. Louis, Mo., U. S. A.

DR. HENRY U. BARBER OF NEW YORK, PRESIDENT OF THE AMERICAN ASSOCIATION OF ORTHODONTISTS, 1940-1941.